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Learning by Experience—

ON our excursions through the British aircraft industry we are able to make a fair appraisal of the current topics of conversation. There is no doubt that many thousands of men and women who at present earn their living by helping to make aeroplanes are wondering what the future holds for them; whether, in fact, they ought to move into another business.

The whole question of aeroplanes-versus-missiles has by now been argued *ad nauseam*, and we need say no more on the matter other than that nothing is going to happen overnight. But much is going to happen over the next ten years, and many of us will be directly affected. Particularly interested in the changing character of the industry are the men who are responsible to their employees on the one hand, and to their shareholders on the other. And the one thing that they can be thankful for is that America has met the problem first and that they can learn by her experience.

At present roughly 35 per cent of the U.S. Air Force's expenditure on new procurement is being devoted to guided weapons, and by 1961 the total will reach 50 per cent. There is not a single major prime contractor building combat aircraft for the U.S.A.F. who is not also deeply engaged in the missile business. As far as can be learned from published information only four British companies can say the same. The comparison is heightened by the fact that at least nine of the American firms are missile contractors to the U.S. Army, and have severed all ties with their former trade.

Assuming that a firm enters the missile business, what then? The first setback to an airframe builder is that the missile structure is a tiny drop in an ocean of business concerned with electronics, advanced research, support gear and other special equipment. The big money goes to the people who make things to put in the missile or the extraneous weapon-system components which come with it.

—from Others

The American airframe builders are overcoming the problem in two ways: by amalgamating with electronic firms and by entering new fields on their own account. Almost daily a new "tie-up" is reported between an American airframe builder and a maker of special materials, transistors, super-conductors, or what you will; and it is surprising what sort of things American ex-aircraft makers are turning out along with their missiles. Martin, for example, make the Matador tactical missile; but for each Matador they also manufacture a car-park-full of trailers, trucks, caravans, mobile maintenance bases, cranes, cases and a host of other items unlike anything previously seen in the Baltimore aircraft plants. Martin also produce an Army bombardment weapon-system called Lacrosse, which resembles an aeroplane only in that it flies.

It is significant that, in general, the American airframe firms have not curtailed their ability to make aircraft, but have expanded their floor-space with new missile plants. In fact the missile facilities of Convair, Martin, Douglas, Boeing, Lockheed and North American represent major capital investment—much of it company money.

Convair, who make the Navy's Terrier at Pomona, Cal., deliver the weapons for a fixed price, plus incentive. Such business generally works on a narrower profit-margin than was customary with aircraft, and substantial capital increases are the accepted method of staying in business. By the same token, accessory makers are finding missiles and their support systems less easy than aeroplanes from the viewpoint of making money. By and large, a missile has fewer accessories than has an aeroplane, and the one-shot character of the device robs the maker of fruitful years of spares-provisioning. Many American companies are irked at the thought that they make perhaps ten cents profit by supplying a sealing ring for a million-dollar weapon system; and the seal has to work first time, so no spare is needed.

We in Britain are bound to meet a similar situation. We can count ourselves fortunate in that, of every hundred new problems posed by the bulk manufacture and operation of missiles, ninety-nine have already been solved across the Atlantic. It is up to us to find out which solutions will suit us best.

FROM ALL QUARTERS

Super Sabre Endurance

THREE North American F-100C Super Sabres of the 452nd Squadron, 322nd Fighter (Day) Group, based at Foster A.F.B., Texas, flew from London Airport to Virginia on May 13 to participate in the Jamestown celebrations. On the previous day they had been named (by Lady Churchill; Mrs. John Hay Whitney, wife of the U.S. Ambassador in London; and Mrs. W. S. Morrison, wife of the Speaker of the House of Commons) after the three little English ships which sailed the Atlantic in 1606 and 1607, carrying settlers who formed the first permanent colony at Jamestown. The names—*Susan Constant*, *Godspeed* and *Discovery*—were painted on the noses of the aircraft, which were flown, respectively, by Colonel Carlos M. Talbott, Major Robert L. Koles and Major Charles C. Jones. They reached their destination after a flight-refuelled Atlantic crossing in 7 hr 33 min. The Super Sabres carried facsimiles of two seals of the James I period, a copy of the original charter under which the voyage and settlement were made, coins from the reigns of James I and Elizabeth II, and copies of London newspapers.

Interviewed by *Flight* at London Airport on the Saturday preceding their departure, the pilots said that they intended to fly at about 35,000ft and at Mach 0.85. Each machine carried two under-wing tanks of 450 U.S. gallons. The tankers were Boeing KB-50 "three-pointers." To combat fatigue the F-100 pilots were provided with sugar cubes or sweets, sandwiches filled according to instructions of the flight surgeon, and stimulants colloquially called "go pills", for consumption about half way across the Atlantic.

Fine achievement as it was, the flight to Jamestown was surpassed on the same day by three other Super Sabres of the same unit; starting from London Airport, they flew the Atlantic and continued across the American continent to land at Los Angeles International Airport, having flown 6,710 miles non-stop in 14 hr 5 min. This is the longest flight on record by single-engined jet aircraft. The pilots were Capts. Engle and Bryant, and Lt. Workman.

F.A.I. Awards for Peter Twiss

THE Royal Aero Club announces that the Gold Medal of the Fédération Aéronautique Internationale for 1956 is being awarded to Mr. Peter Twiss, in recognition of the fact that in making his world air speed record of 1,132 m.p.h. on March 10 last year he was the first man to be officially timed in accordance with F.A.I. regulations while flying at a speed of over 1,000 m.p.h.

The de la Vaulx Medal for 1956 has also been awarded to him for obtaining the record. Presentation of both medals will take place during the Federation's annual conference at Palermo on June 24.

The F.A.I. Gold Medal was instituted in 1925 in order to provide annual recognition of outstanding contributions to aviation. Previous British winners have been Sir Alan Cobham (1926), H. J. L. Hinkler (1928), C. W. A. Scott (1934), Jean Batten (1937) and A. Cdre. Sir Frank Whittle (1950). The de la Vaulx Medal was instituted in 1933 to commemorate a past president of the F.A.I., the Count de la Vaulx; it is awarded annually to holders of F.A.I. records confirmed during the year.

Jet Provost Co-operation

IN the introduction of the Hunting Percival Jet Provost to export markets Hunting Percival Aircraft, Ltd., and the de Havilland Aircraft Co., Ltd., are to collaborate. Thus (according to a joint announcement) "the full strength of the de Havilland world-wide organization is now associated with Hunting Percival in making the Jet Provost speedily available throughout the British Commonwealth and foreign countries." The "J.P." will be offered with armament to cover the weapons training and policing rôles. As a trainer, of course, it is complementary to the D.H. Vampire Trainer.

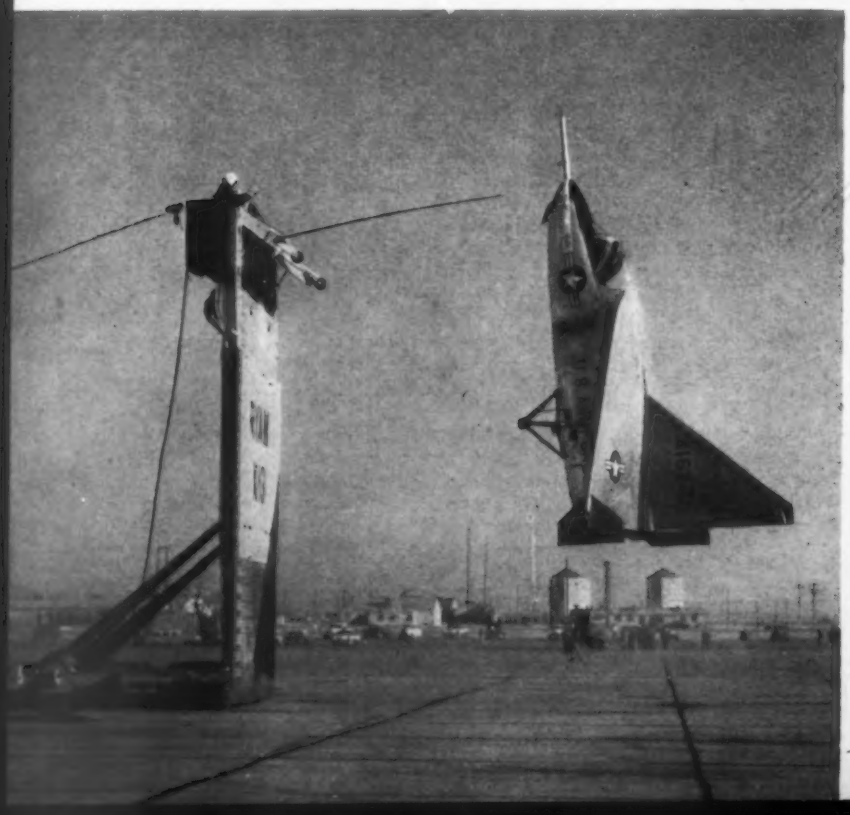
Ryan's Vertijet

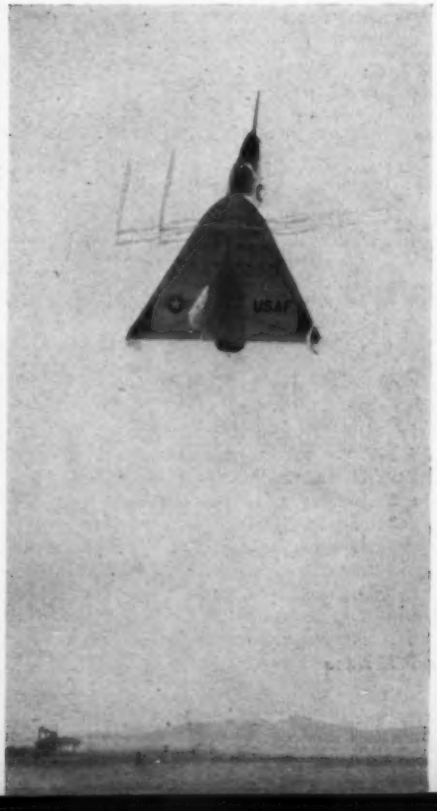
POWERED by a special Rolls-Royce Avon turbojet (chosen for its favourable thrust/weight ratio), the Ryan X-13 Vertijet of the U.S. Air Force is illustrated in the two photographs below. It is the first all-jet machine to have gone through the complete cycle of vertical take-off and landing and translational flight.

Ryan have been heavily engaged in VTO work since they received a Navy study contract on April 24, 1947. On October 20, 1950, a pilotless test-rig was hovered in tethered flight by remote control, and free hovering was conducted with a remotely controlled Allison J33 in May 1951. The company's chief engineering test pilot, "Pete" Girard, made the first piloted hovering jet flight with a modified rig on November 24, 1953.

A contract to design, make and test two X-13 research aircraft was placed by the U.S.A.F. in August 1953; construction of the first began at San Diego in the following January, and Girard flew the aircraft from a conventional take-off at Edwards A.F.B. on

VERTIJET: Aptly named, Ryan's bat-like VTO aircraft is powered by a single Rolls-Royce Avon turbojet with a thrust appreciably greater than the gross weight of the aircraft. It has already flown straight up to 10,000ft from a standing start.





"SUSAN CONSTANT" was the historic name conferred upon this North American Super Sabre at London Airport last Sunday by Mrs. W. S. Morrison, wife of the Speaker of the House of Commons. Two others were christened "Godspeed" and "Discovery," as related in the first news item on the opposite page.

December 10, 1955 (temporary conventional landing gear was fitted). On May 28, 1956, hovering flights were conducted in the vertical attitude from a "tail-sitting"; on November 28 a full transition flight was made from the runway at Edwards; and on April 11 last the final complete cycle of translational flight was effected from vertical take-off and landing.

The X-13 has a large subsonic wing of 21ft span and essentially delta form; the length of the aircraft is some 24ft and the height is 15ft. The wing carries fixed end-plates and movable elevons, and the large fin carries a split rudder. Compressor-bleed air is fitted to control jets pointing backwards (i.e., downwards during hovering) from the wing-tips. Hovering control is also effected by deflecting the jet nozzle. Pilot comfort is increased by tilting the seat forwards some 70 deg when the X-13 is vertical.

As one of the photographs shows, the aircraft operates from a flat platform on the bed of a large truck which, when extended vertically by hydraulic rams, provides a horizontal bar on which the aircraft can perch with the aid of the hook beneath its nose; at rest the X-13 hangs like a bat, with its twin legs resting gently against its bed.

Ryan is working on another jet VTO aircraft under a joint contract from the U.S.A.F. and Navy. The new machine is likely to be a high-performance design suitable for operational use.

Shackletons for the S.A.A.F.

YESTERDAY, May 16, the South African Air Force was due to take delivery of the first two of its Avro Shackletons at a ceremony at the makers' airfield at Woodford, Cheshire.

The aircraft—first of eight Mk 3s ordered by South Africa—was being handed over by Mr. J. A. R. Kay, director and general manager of A. V. Roe, to the South African Deputy High Commissioner, Mr. W. D. van Schalkwyk, receiving them on behalf of No. 35 Squadron, S.A.A.F. Three crews from No. 35 Sqn., together with ground personnel, under their C.O., Cmdt. M. J. Uys, have been undergoing a familiarization course at Woodford for the past few weeks.

Defence in the Lords

IN the defence debate in the House of Lords on May 9, Lord Selkirk (First Lord of the Admiralty) said that, although the manned supersonic bomber had been cancelled, a large volume of supersonic research and development remained in our programme. He mentioned the Government's determination to press on with the study of supersonic transport aircraft which has been launched in consultation with a number of aircraft companies. We had to study whether it was worth-while producing a prototype, but measures were being taken which could lead to a prototype being built.

Lord Tedder remarked at one point in his speech: "If the development of these mystic missiles or misguided projectiles proves, in fact, to be slower than anticipated, the failure to develop the supersonic manned bomber and the successor to the P.1 might well result in leaving us facing a dangerous gap in our defences. It is true that in many respects development, as I have said, has been very rapid; but, on the other hand, I think it is as well to remember that the Americans, with almost unlimited resources, have poured many millions into development and research in this field for the last twelve years. I believe they are still hunting the Snark in Central Brazil."

A summary of the Commons debate on the Air Estimates appears on page 673 of this issue.

MR. HAROLD BEST-DEVEREUX, until recently senior surveyor of the Air Registration Board, has been appointed chief of the sales organization of Edgar Percival Aircraft, Ltd. Particularly well known in connection with ultra-light aircraft, he is a member of the executive committee of the Popular Flying Association and chairman of its airworthiness committee, as well as being a member of the Royal Aero Club's aviation committee. During his aviation career he has worked for several prominent firms; and in the war he was commissioned in the R.A.F.V.R. and was also engaged on technical work at the Admiralty.

Pioneer Spirit

HOME from a demonstration tour which took in Central and South America, Mr. D. F. McIntyre, managing director of Scottish Aviation, Ltd., reports great breadth and depth of interest in the Scottish-built STOL (see page 665). Business in prospect is such that Armstrong Whitworth have been given a sub-contract order for detail parts and certain main components.

In Switzerland, David A. Anderton, of *Aviation Week*, has been observing Swissair trials, and though reporting "limited single-engine performance" under the extremely arduous conditions encountered on these operations, comments enthusiastically otherwise. Swissair has suggested to Scottish Aviation the fitting either of two Turboméca turboprops or an auxiliary turbojet in the tail. The R.A.F. version, it is learned, will be able to carry bombs in "limited" campaigns.

In conjunction with the forthcoming Paris Salon a Twin Pioneer will be operating a passenger service between Issy (Paris) to Le Bourget and will thus be a rival attraction to the two Vertol 44 helicopters (*Flight* last week).

Southend Move

PROMINENTLY associated with the development of the Accountant turboprop airliner—illustrated on this page last week in its finished form—Messrs. L. C. Heal, S. J. Smyth and N. A. J. Serpell (portraits below) have been elected to the Board

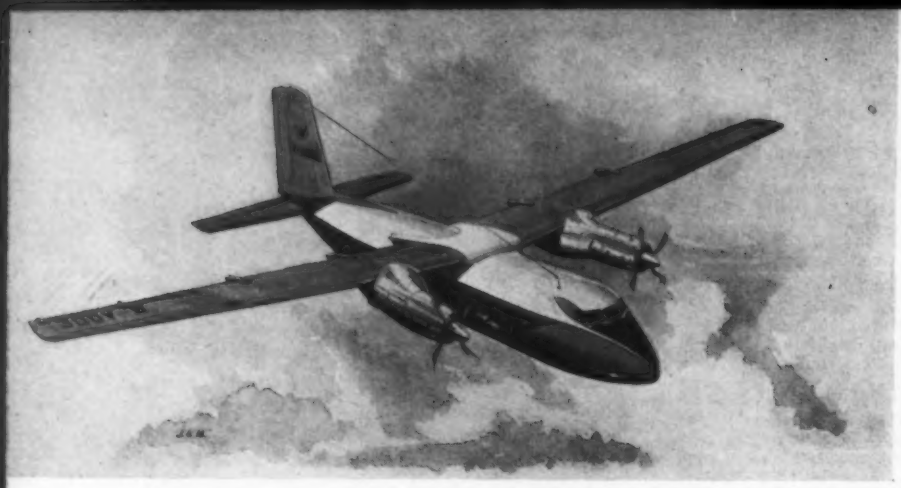
Left to right: Messrs. Heal, Smyth and Serpell.

of Luff and Smith (Designs), Ltd., consulting aeronautical engineers and designers. Mr. Heal was with Aviation Traders (Engineering), Ltd., for four years as chief designer of the Accountant, and he is the inventor of the tensioned-skin method of construction used in that aircraft. We hope to publish further details of the new venture next week.

Valiant Incident

A RECENT incident at Boscombe Down, when a Valiant cracked a rear spar member after a rocket-assisted take-off in overload conditions, was the subject of a statement last week by Vickers-Armstrongs (Aircraft), Ltd. Emphasizing that this particular aircraft was a prototype used for experimental work, the company said that the failure "was in no way connected with the rocket-motor trials, which functioned satisfactorily." Valiants in R.A.F. service would not be affected.

The incident occurred some time after the take-off. The pilot made an uneventful landing, undercarriage operation was not interfered with, and the aircraft was taxied to its parking-place in the normal way.



"Flight" copyright drawing.

THE DART HERALD

More Details Disclosed by Handley Page

AS briefly recorded last week, Handley Page have announced a version of the Herald powered by two Rolls-Royce Darts, to be built in parallel with the Herald with four Alvis Leonides Majors. The new version will be known as the Dart Herald.

Modification of the prototype, G-AODE, is due to start shortly at the Handley Page (Reading), Ltd., factory at Woodley, centre of Herald design, testing and production. The company hope to have the Dart Herald ready for flight-testing by March next year, and they are aiming to have airworthiness certification and actual production deliveries by the following autumn.

This is an uncommonly quick schedule, even taking into account the fact that a large part of the certification work for both airframe and Dart is already well advanced.

The version of the Dart to be fitted is the Model 527, a member of the R.Da.7 family which will power the later 810-series Viscounts. The Dart 527 develops 1,910 s.h.p. or, allowing for a jet thrust of 515 lb, 2,015 e.h.p. Two will provide the Herald with an extra 700-odd equivalent horse-power, while at the same time saving about 2,400 lb in basic equipped weight.

Purchase price will be £175,000 without radio, an increase of about £20,000 on the piston-engined version, but still a highly competitive price. Despite the increase in first cost, direct operating costs should work out at rather less than those of the piston-engined version, by virtue of the greater speed (up by 70 m.p.h. to 275 m.p.h.) and reduced engine maintenance costs. Handley Page have not released detailed cost figures, but quote an operating cost of "less than 1¼d per passenger-mile and 16d per ton-mile."

The market for the piston-engined Herald, encouraging when the aircraft was first announced two years ago, has since been more and more influenced by increasing world acceptance of the turbine for local-service operations—a state of affairs brought about solely by the Dart. Among the airlines who have been associated with the Herald order-book—A.N.A., Queensland Airlines, Lloyd Aero Colombiano and Air Kruise—the two Australian companies in particular (and, in recent weeks, another Australian operator) have lately said in so many words: "We want Heralds, but we would prefer them with Rolls-Royce Darts."

Production of the Leonides Herald will continue (Handley Page mention the possibility of 25 or more sales), and the company and indeed all the operators with whom they have negotiated recognize that the Leonides Herald will remain the better aeroplane in many respects, with the notable exception of speed. In field and climb performance in hot-and-high conditions the Leonides Herald is inevitably superior.

The decision to go ahead with the Dart version does not imply a Handley Page *volte face*. It appears to be sensible recognition of the fact that no matter what the maker's slide-rules say, the customer is right. It is furthermore an immense tribute to Rolls-Royce.* As G/C. R. C. M. Collard, Handley Page's sales manager, said a few days ago: "It is not simply turbines that operators are interested in—it is the Rolls-Royce Dart."

With other turbine competitors already in the field, does the Dart Herald appear on the market too late? A potential market for as many as 3,000 aeroplanes in the branchliner class, excluding military requirements, can be foreseen for the next fifteen or twenty years. To date fewer than 100 have been ordered. Moreover, it appears from the Dart Herald programme that Handley Page will be able to offer deliveries to operators who are seeking new branchline equipment before its closest rival, the Friendship, comes off the Fokker production lines.

Main airframe differences in the Dart Herald compared with the Leonides version are: (1) a 19in increase in fuselage length (forward of the wing), made for c.g. reasons; (2) a new production centre-section and some airframe strengthening; and (3) outer-wing integral tanks.

HANDLEY PAGE DART HERALD

(Two Rolls-Royce Dart RDa.7 527, each rated at 1,910 s.h.p.+502 lb thrust)

Dimensions: span, 94ft 9½in; length, 71ft 11in; height, 22ft 4in; wing area, 886 sq ft; cabin length, 43ft 8in; cabin height, 6ft 3in (75in); cabin width, 8ft 6in (102in); gross cabin volume, 2,152 cu ft.

Basic data: fuel capacity, 1,000 Imp. gal (1,200 U.S. gal); oil capacity, 6 gal; main tyres, 34 x 11.75-14 (60 lb/sq in); nose tyres, 23 x 7.25-10.

Weights: basic equipped, 22,808 lb; zero-fuel, 32,968 lb; payload (36 seats), 10,160 lb; maximum take-off and landing, 37,000 lb.

Performance (I.S.A.): take-off and landing at sea level at 37,000 lb: two engines to 50ft, 717 yd (2,151ft); to 50ft, one engine out at safety speed, 1,390 yd (4,170ft); take-off speed, 109 m.p.h.; landing from 50ft, 730 yd (2,190ft); approach speed 1.3 V_s, 104 m.p.h.; touch-down, 95 m.p.h.

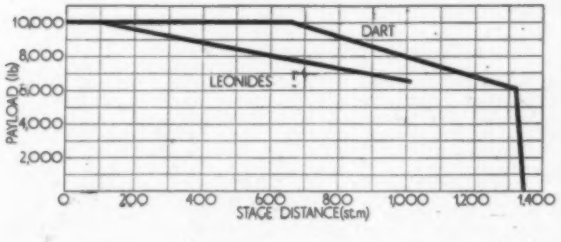
Maximum continuous climb, both engines, 37,000 lb: rate of climb at 10,000ft, 1,250ft/min; time to 10,000ft, 6.7 min; service ceiling, 29,500ft.

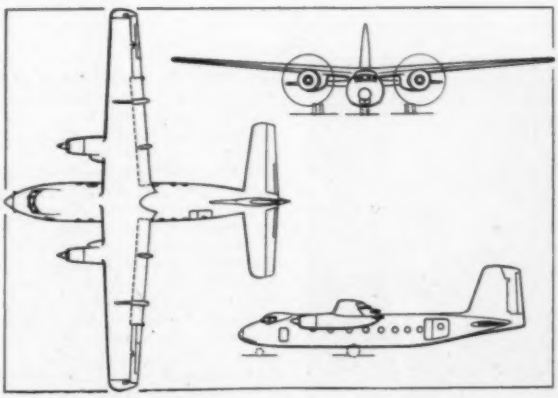
Level, both engines, 36,000 lb: at 15,000ft, recommended cruise (13,800 r.p.m.), 275 m.p.h.

Range/payload at 15,000ft (full allowances for take-off, climb and descent, but no diversion): range with 10,160 lb (maximum) payload, 657 st. miles; payload for 800 miles, 9,200 lb; range with full tanks and 6,090 lb payload, 1,325 miles; mean cruising speed, 275 m.p.h.; mean consumption, 206 gal/hr.

** Of the ten new European and U.S. turbine transports on the market (Herald, Friendship, Viscount, Vanguard, Electra, Caravelle, Comet, Britannia, DC-8, 707) all but one are being offered with Rolls-Royce engines—Dart, Tyne, Avon or Conway.*

Below, a "Flight" sketch of a typical payload-range comparison between the Dart- and Leonides-powered Heralds, with allowances for take-off, climb, cruise and descent. Right, general arrangement. The nose is 19in longer, and propeller diameter is 12ft 6in, with a fuselage clearance of nearly 2ft. Dimensions are as set out in the table above.





A Great Aerodynamicist

— is Saluted by Another: Dr. von Kármán's Appreciation of Frederick William Lanchester in R.Ae.S. Lecture

Dr. Lanchester — a photograph published in "Flight" in 1913. At that time—and right up to 1940—he periodically contributed to this journal articles which aroused world-wide interest and discussion in aviation technical circles.

WHEN the Royal Aeronautical Society held the First Lanchester Memorial Lecture in London last Thursday (May 9) an audience of several hundred heard Dr. Theodore von Kármán—himself one of the world's greatest aerodynamicists (and currently chairman of the Advisory Group for Aeronautical Research and Development of NATO)—give an appreciation of Dr. F. W. Lanchester's work on aerodynamics and operational analysis. It was prepared as a result of the lecturer's own contact with Lanchester and with other people who knew him well.

Frederick William Lanchester, F.R.S., died in 1946 at the age of 78. He was one of the earliest English aerodynamicists, and his theories about aerofoil sections still form the basis of wing design today. Although perhaps better known to the general public as a brilliant automobile engineer (he was the mainspring behind the development of Lanchester cars), Lanchester was the man who really discovered the origin of the lifting power of the fixed wing.

It was in 1897—six years after he began his serious study of flight—that he tried, but failed, to interest the Royal Society and the Physical Society in his circulation theory of sustentation. "It was remarkable," said Dr. von Kármán, "that his papers could be refused by the learned societies of his country." In the ten years between the rejection of Lanchester's papers and the publication of his book *Aerodynamics*, continued the lecturer, two mathematicians—Kutta, a German and Joukowski, a Russian—completed the theory as far as the aeroplane wing of infinite span was concerned. It was true that, because of the coincidence of their efforts and Lancaster's delayed publications, Lanchester's priority for the circulation theory was questioned; but he recognized the general mechanism of lift and induced drag for the case of the aerofoil with finite span, for which the systematic mathematical theory needed approximately another decade. Lanchester gave priority to his study of the circulation theory—and this was, in the lecturer's view, absolutely the right thing to do. Later he extended to propellers his study of the theory in relation to wings.

Lanchester studied both the swift and albatross, and decided that these birds were stable. He considered that Lilienthal's glider was unstable. This same conclusion had also been drawn by Wilbur Wright—"and, of course," said the speaker, "Lilienthal killed himself."

Some of Lanchester's early predictions, which he himself lived to see proved wrong, could be recalled. He thought that an aircraft weighing three tons would need a speed of 50 m.p.h. to enable it to fly, and that therefore aircraft weighing more than a few tons would never be; that one day aircraft might be able to fly 2,000 miles ("a modest prediction," observed Dr. von Kármán); that before high speeds could be attained the engine weight/power ratio would have to be reduced to about 31 lb/h.p.; and that no more than 150 acres of land should be sacrificed for landing grounds. And Lanchester added that such grounds could, if properly managed, be used for grazing cattle as well as serving as landing grounds.

Dr. von Kármán, who delivered the lecture. His important aeronautical work during the past 50 years has been conducted in Hungary, Germany, Japan, China, America and France. He is now chairman of the NATO Advisory Group for Aeronautical Research and Development.

The lecturer continued: "Whether or not Lanchester was a visionary depends on the interpretation of the word. If it means a man who has extraordinary vision—a deep insight into the problems he considers—he certainly was a visionary. However, he was not a visionary in the sense that in following his imagination he would overlook realities, or difficulties in realization." Some of his predictions [as shown above.—Ed.] were rather too cautious and were not visionary, "as I am afraid certain predictions of some of our brethren engaged in astronautics are today."

On Lanchester's work on operational analysis of aircraft, Dr. von Kármán said that he became one of the fundamental sources for this work at the time of the First World War. He was deeply interested in the operation of aircraft in war, although it was hard to say when the idea of aerial warfare really started. Here the lecturer showed a slide of an old print showing two warlike gentlemen, with balloons hitched to their uniforms, clashing swords high above the ground.

Sir George Edwards, the new R.Ae.S president, said that the Society's named lectures already paid tribute to great pioneers of aviation from the United States and France—Wilbur Wright and Louis Blériot. It was, he thought, fitting that there should now be a lecture in memory of a great Englishman.

Sir George Edwards was chairman for Dr. von Kármán's lecture. This was his first R.Ae.S. meeting as the Society's newly installed president. Sir George's assumption of his new office is depicted on page 670.

FOR BETTER HUNTING: This experimental version of the Hawker Hunter was a converted F.4, carrying A.I. radar and having an armament of two 30 mm Aden guns. No further development is foreseen.

HERE AND THERE

Sikorsky Retiring

THE retirement late this month of Igor Sikorsky has been announced by United Aircraft Corporation. The great Russian-born pioneer, designer and constructor of helicopters will be 68 years of age on May 25.

Swedish Hunters Fly Again

THE Swedish Air Force has lifted the ban which, following a series of accidents, it recently imposed on the flying of its Hawker Hunters. Fuel pollution has been quoted as a suspected cause of the crashes.

Aden Gun Contract Ends

PRODUCTION of the Aden 30 mm gun by B.S.A. Guns, Ltd., at their Merthyr Tydfil factory is to cease on July 4, when the M.o.S. contract for these weapons ends. The Aden gun is standard equipment in the Hawker Hunter, Gloster Javelin and Vickers-Supermarine Scimitar.

Money Back

THE Government levy on sales by the aircraft industry, designed to offset public expenditure on development of the aircraft or engines concerned, is expected to produce £5,600,000 in 1957-58. This news was given in a written reply last week by Lord Mancroft, Parliamentary Secretary to the Ministry of Defence.

Remembering Lord Wakefield

INAUGURATING "Wakefield Day" at Hythe, Kent, on May 6, Sir Cullum Welch, Lord Mayor of London, described the late Lord Wakefield of Hythe as "a great patriot and a great believer in the British Empire" who was one of the first men of authority to understand the opportunities opened by the conquest of the air. "British aviation today," added Sir Cullum, "owes an incalculable debt to his vision and his material support."

Peak Employment

DURING January this year 266,600 people were employed in Great Britain in the manufacture and repair of aircraft; this, says the S.B.A.C., is a peace-time record. In February the figure fell by 400.

Do-it-yourself Touring

THE New York branch of a French tourist agency is arranging three European tours for American private pilots this summer. The pilots will cross the Atlantic by Air France and fly round Europe in French CP-301 Continental-powered Emeraudes.

Thunderbird

IT was unofficially disclosed last week that the excellent name Thunderbird has been chosen for the English Electric surface-to-air missile system now on order for the Army and R.A.F. A model of the weapon, exhibited in a window of Marconi House, London, shows the combined trailer/launcher.

Revolution and Evolution

LOFT bombing is now possible with the 90-ton, six-jet B-47. At a demonstration at Eglin A.F.B., Florida, on May 6 a B-47 approached a target "on the deck," pulled up into a steep climb, released a dummy atomic bomb and rolled-off-the-top to escape in the opposite direction before the bomb found its mark. A smoke device was attached to the bomb to show its path towards the target. The U.S.A.F. define this new adaptation of the B-47 as "a revolutionary addition to strategic bombing tactics."

Bristol Earnings Up

ACCOUNTS of the Bristol Aeroplane Co., Ltd., issued in advance of the annual general meeting on June 6, show a net profit of £1,065,028 (1955, £977,363) after allowance for taxation at £781,949 (1955, £762,191).

Adhesion—and Why

WITH the succinct title *How Glue Sticks*, a lecture is to be given to the Royal Institution on May 31 by Dr. N. A. de Bruyne, M.A., Ph.D., F.Inst.P., managing director of Aero Research, Ltd.

In the Air, On the Air

NEXT Saturday, May 18, in the B.B.C. Light Programme series *Out And About*, Raymond Baxter will talk to members of a B.E.A. aircrew-selection board and describe instruction which he will undergo in a Link Trainer and a Pionair. Mr. Baxter flew as a squadron leader in the R.A.F. during the war. Entitled *Golden Wings*, the feature is at 4.20 p.m.

92-8 Chance

A SPECIAL escape-system "package" has been designed for the North American X-15 rocket-powered research aircraft which is to be flown by company test pilot Scott Crossfield next year. Crossfield is reported to have stated that the device will give him a "92 per cent chance" of survival even in the most unfavourable circumstances. The U.S.A.F. is supplying the pilot's personal equipment for the system.

DUTY DONE: The name painted on this Swedish-registered Bell 47 is based on the initials of the Falkland Islands Dependencies Aerial Survey Exhibition, whose ship "Oluf Sven" docked at Harwich last Monday. This photograph was taken at Deception Island when the expedition—which also operated Canso amphibians—was packing for the homeward journey. The helicopter pilot was Mr. J. Patcha of Autair, Ltd.

AIR FREIGHTING

The Cargo Business and its Equipment: Part I

By ALAN H. STRATFORD, B.Sc. (Eng.), A.F.R.Ae.S., M.I.Ae.S.*

One of the most successful post-war examples of the all-freight aircraft was the Bristol Freighter. A Mk 32 is seen here in the rôle for which the aircraft has become best known—as a vehicle ferry.

IN the years between the wars, when the cause of civil aviation was not yet widely accepted, it was easier to plead the case for the cargo and trading aeroplane than for the passenger-carrying machine. The air passenger was then thought to be something of an eccentric, certainly well-to-do and never likely to be found in large numbers. Besides, there were so many other practicable and even profitable things that an aeroplane could be shown to do. There was crop-spraying, for instance, and oil pipeline inspection, supply dropping, and mail-carrying to inaccessible communities.

And, of course, freight-carrying. Was this not a prime reason for the existence of the commercial aeroplane? There had already been a number of surprising exploits in which heavy loads had been carried to outlandish places. There were exceptional and sometimes strange cargoes, and much had been written about their *ad hoc* transportation by air. Some independent operating companies had even been formed to do this job, and "aerial work" was a nice phrase coined early on for these broader activities of air transport.

Everyone knew that the world's railway systems earned a high proportion of their revenue from freight, and we presumed it would one day be the same with air transport. But the post-war expansion of air transport has shown how wide of the mark we were. The expansion has been largely in passenger traffic, and the demand for freight space has been poor by comparison.

To the business man and shipper, it is purely a matter of economics. How do the costs compare? Often the time saved is no justification for the cost. Sometimes a real advantage can be shown, and a lucrative air-freight business may grow up. The variations in the cost and the balance of advantage are sometimes difficult to assess, and operators themselves may come to different conclusions based apparently on the same set of facts.

But the transport aeroplane has become a vital factor in the complex of industrial societies, and it cannot rely for long only on the movement of passengers. The long-awaited era of industrial trade by air may be with us sooner than we think; but unless the right machines are available there is little hope that we shall be able to exploit it to the full.

Have the airlines been too concerned with the more profitable passenger business to turn their full attention to freight, or have they not had the right aircraft to operate effectively as freighters or on general trading duty? Are the current surface-freight rates so much lower than the air rates that the aeroplane has little hope of offering competition, except in favourable circumstances with particular products and in individual markets? Finally, can the manufacturer of aircraft and powerplant, or the engineers and scientists who advise him, do anything to help the airlines in their plans for more economic general transport operations?

I.C.A.O. records that in 1955, for the first time in aviation history, the percentage increase of world air freight exceeded the rate for passenger traffic. This increase of 19 per cent was, for the first time since 1947, greater than that of the previous year. The recently published figures for 1956 show a similarly favourable expansion. Has the corner been turned? These thoughts must occur to any aeronautical engineer who has wondered at the slow headway made by air cargo. I myself am now convinced that the British aircraft designer, who must always be four or five years ahead of the traffic demand, is offered a great chance today if he recognizes the opportunity and knows clearly the requirements of the operating industry.

The opportunity seems to depend on two main factors. One is the possibility for imaginative use of the turbine powerplants which have reached such a high pitch of development in this country since the war. Their high output, low weight and simplicity confer a great economic advantage over the piston engine. The second factor is the marked advance that has been made in the last ten years in the understanding of air transport operational problems, and in the maintenance and engineering techniques applied to transport aircraft.

Most of this experience has so far been gained in passenger transportation, and the bulk of air freight has been carried in passenger aircraft. But the experience thus gained is now at the disposal of the manufacturers of all-freight or trading aeroplanes.

The Growth of World Air Transport. Published statistics tell us a good deal. In 1955 the world's operators carried 907 million short ton-miles of air freight. As stated, this was the first year since 1947 that the percentage increase in air freight was greater than that in the previous year. In 1955 there was an increase of more than 70 per cent above the total for 1950; but during the same five-year period, world passenger traffic increased by over 120 per cent—and today it represents four times the transport load of air freight. In 1956 the movement of world air freight increased to 1,030 million ton-miles, a 13 per cent increase over the previous year.

A curve of the rate of growth of world air freight is illuminating. The phenomenal rate of growth from 1946 to 1947 was temporary, and from 1948 to 1953 a steady annual *decrease* in rate occurred. The rate of increase has picked up in the last two years and today's considerable growth and rate of growth is striking.

Certain particular aspects of air freighting must be studied if the statistics are to be understood correctly. Firstly, in comparison with passenger traffic, air freight always provides a far smaller proportion of airline revenue per load ton-mile. Further, the load-factors achieved with freight are generally lower than passenger load-factors. Figures from the airline records of Europe and America show that there are few airlines with overall freight and mail load-factors exceeding 50 per cent; and in the case of operators who have no purely freight aircraft, but who provide freight capacity entirely in the holds of passenger aircraft, the overall load-factors are considerably less.

The Air Research Bureau, whose analyses of the European operations of its nine member-airlines and two associates are of great importance, found that in 1953 the average freight/load-factor on freighter services was 54.5 per cent, while on passenger aircraft varied widely but averaged only 32 per cent. This pattern would probably be reflected in the United States, and it suggests an excess of capacity in high-frequency passenger aircraft services which are not linked in any way to the requirements of the cargo shipper.

Whether or not the current types of freight aircraft can support the air-freight transport business at its present rates will be considered later; but it must be accepted that in Europe, where over 80 per cent of freight is carried in passenger aircraft, such a low load factor is bearable only if the passenger aircraft is providing

**Civil aircraft adviser to the chief designer, Sir W. G. Armstrong Whitworth Aircraft, Ltd.*

Although never designed as freighters, probably more DC-3s are flying in this capacity than on passenger work. They are not ideal —even with their doors enlarged as on this British independent operator's aircraft; but they can offer highly competitive rates, simply because, as they are old aircraft, depreciation is written off the books.

AIR FREIGHTING . . .

cargo space at minimum additional cost. This, of course, does not necessarily mean that the passenger is subsidizing cargo, but it may help to explain the slow development and infrequent operation of specialized cargo aircraft.

At the present time between 50 and 60 per cent of air freight carried within the U.S.A. is transported in all-freight aircraft, and this must be interpreted as a measure of the advance made in the economy of this type of operation in America. At the end of World War II, out of the many operators of ex-U.S.A.F. equipment competing for freight business, Slick Airways and the Flying Tiger Company were the most successful. Their expansion was remarkable. Each of these all-freight operators carried in 1953 more than double the air freight carried in Europe.

But the traffic carried by the major U.S. freight airlines decreased steadily from 1952 through 1954 to such a degree that a merger of the Flying Tiger Line and Slick Airways was proposed. The plan, which received the approval of the C.A.B., was not carried into effect for financial reasons.

The strengthened position of the great American carriers of passengers, mail and freight lent weight at that time to the view that they could provide a greater flexibility of service and economy than the all-freight operator, whose aircraft required large loads for economy and could not provide a service on routes lacking the necessary density of freight traffic.

Now, however, the U.S. all-freight carriers have re-established themselves and Slick Airways have on order five DC-6As for delivery in 1958. At present they operate 6 DC-6As, 8 DC-4s and 17 C-46s. Seaboard and Western Airlines, another long-established U.S. all-freight operator of non-scheduled services, flew over 15 million freight ton-miles in 1955. They recently obtained sanction for the operation of scheduled transatlantic cargo services with connections to London, Paris, Brussels, Amsterdam, Geneva, Zurich, Frankfurt, Munich, Stuttgart and Hamburg.

The success that may be achieved by intensive efforts to develop the air freight market may be illustrated by B.E.A., whose 1955-56 drive for freight resulted in a 32 per cent increase in this type of traffic. This expansion, which is continuing steadily, was made possible by the increased frequency and capacity of new passenger aircraft, but all-cargo operations provided an essential complementary service. The Corporation's annual report for 1955-56 states that "the future development of all-cargo services will be required to keep pace with the expansion of the passenger services so as to maintain a comprehensive service to the shipper and especially to deal with bulky loads and other types of freight unsuitable for carriage in passenger aircraft."

Among the major world operators K.L.M. are outstanding in generating as much as 12 to 13 per cent of their total revenue from freight.

Such figures are representative of operations between the large industrial communities of the West, but they are not typical of undeveloped territories. There the movement of mail and freight by air has made slowly accelerating progress since before the Second World War. It is perhaps to be expected that, where surface transport is really primitive, air cargo tends to promote a greater proportion of the air transport business. Moreover, the air-lifted share of the *total* freight movement should also increase enormously; South America and Australia provide outstanding examples.

The post-war development of air freight in Brazil is one of the great aviation stories not yet adequately told. DC-3s and DC-4s are operated very extensively, but a large potential market for new all-freight aircraft in such territories must certainly already be in existence. Mr. Jack Frye, who is sponsoring the Safari, has recognized the possible field for a robust machine to operate in outback territories, and he is reported to have stated that there is "a lucrative opportunity everywhere for an aeroplane which can operate at rates comparable to those of the truck or bus."

Undoubtedly a great deal of the success of freight operations has come from the availability of aircraft such as the DC-3 and DC-4 at low secondhand prices. However, it would be folly to forget that these aircraft will need to be replaced one day and a new wider market for air freight will follow the introduction of more advanced aircraft intensively operated in a freighting rôle.

The future of air cargo in Europe, where there are well developed surface communications, will depend on slow long-term expansions into the most profitable markets. Everything will depend on the reduction of freight rates, and there exists the long-term aim for a deep penetration into new markets. The immediate expansion in Europe is anticipated largely in products already established as suited to air transport. When traffic levels reach the point where all-cargo aircraft are essential in greater numbers to meet the demand, then the large-scale operation of specially designed freighters will be required.

New methods and concentrated efforts to compete in the new European markets will be essential if Britain is to maintain her position in the proposed Customs-free zone of Western Europe. Britain's high-value industrial products will need the service of air transport to an even greater degree if delays in transport and the cost of handling are not to penalize manufacturers.

B.E.A. and Vickers have gone a long way with the Vanguard to meet the expected growth of air freight in the next decade. Its large freight-capacity suggests a confidence in the immediate future of air freight. Nevertheless, it must remain a compromise.

Economics of Freight by Air. The fundamental aim must clearly be to lower the freight rate. This may be done by improved methods of operation and by the use of more efficient equipment. It may also be achieved by adjustment of the rate structure, so as to encourage the transport of goods which are easier or cheaper to handle, and perhaps to place a premium on others.

In practice, all these devices are developing together, and the gradual expansion of air freight is a measure of the success that is being achieved.

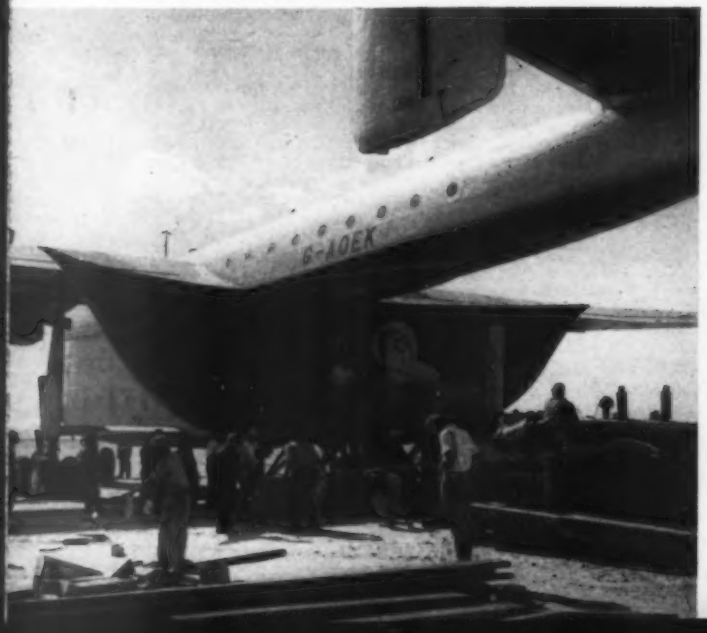
Generally speaking, only a small proportion of air cargo is carried at the standard rate, and the various discounts which are allowed for bulk or special commodities reduce considerably the revenue return for a given transport product. A minimum rate operating on the smallest consignments, usually under five kilos, has the effect of increasing the rate per unit of weight. The same result is achieved by premium rates for special cargoes, such as livestock. In general more than half the loads are carried at basic or bulk rebate rates.

In Europe a characteristic of the freight pattern has long been the predominant quantity of small consignments transported at the minimum rate, but absorbing a disproportionate effort in documentation and handling. I.A.T.A. has now approved a new development known as "consolidation," whereby registered freight agents may dispatch as one consignment a number of small articles and parcels, gaining thereby the quantity rebate for a load above 45 kg. This concession enables a reduced rate to be passed on to the public, and it eases the handling job for the airlines. This practice must be expected to encourage the formation of well organized agencies who will provide a useful function in the development of air freight. This has already occurred in the United States.

Such practices are valuable in establishing a true commercial relationship between the operator and the public. They are predicated upon the increasing efficiency of air freight handling and the development and improved economy of the aircraft itself.

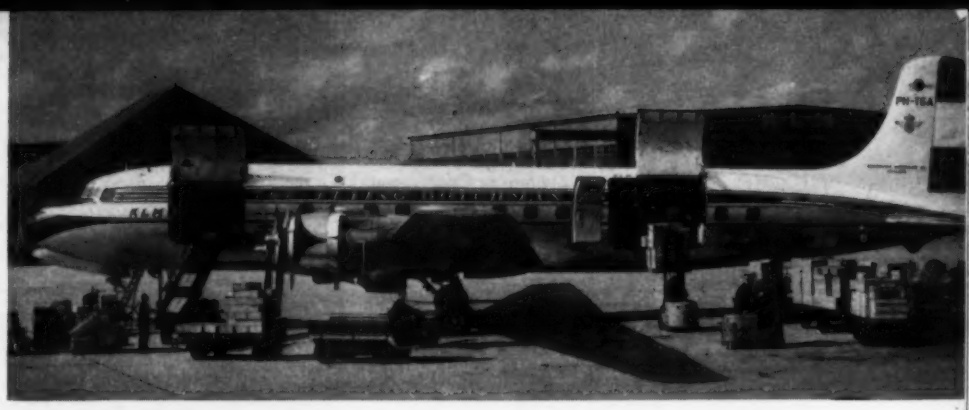
The form of the rate structure which has been built up for air cargo is likely to encourage the transport of specified categories of goods. This clearly is its object. These goods will be of the kind which justify the higher rates of air freight as compared with surface freight, and in which the saving of time and easier handling, packaging or insurance costs may be of value. They tend to be goods that enjoy the commodity discount and have a high intrinsic value compared with total transport costs.

Of the greatest importance among air cargoes, both in Europe and America, are machinery and engineering equipment. These may comprise between 30 and 40 per cent of all cargo uplifted. This proportion will be considerably exceeded in some of the undeveloped areas in the world. It will include radio and automobile parts, electrical appliances and industrial and domestic



A good example of the very big specialized freighter is the Blackburn Universal which, if it can be filled, can offer very low cargo rates. This picture shows the aircraft being used to lift heavy oil-drilling equipment which could not, in the particular instance, have been handled by surface transport.

AIR FREIGHTING . . .



The DC-6A is another freighter converted from a passenger aircraft. It is not ideal (witness the height of the enlarged loading doors from the ground); but, with its Lockheed counterpart, the 1049H, this type is carrying the bulk of today's scheduled air cargo.

hardware. Important also in Europe and America are newsprint, textiles, fresh fruit and cut flowers. Newspapers are reported by the Air Research Bureau to have comprised 10 per cent of air freight in 1953 among its affiliated carriers in Europe. Much local traffic arises, each with a special interest. Horses in Finland, beef carcases in the Australian Northern Territories, and hide-skins and seeds in India and the Far East. In the transport of these goods, however, no great problems are set for the aircraft designer. The aircraft designed for pure freight carriage will in many particulars be different from the passenger aircraft, but the design requirements should not be difficult to meet.

When a greater proportion of the world's air freight is carried in larger all-cargo aircraft it may be that the pattern of traffic will change, but in the immediate future the expansion of trade by air must be expected to develop along well established lines.

It is only too true that the uneconomic state of all-freight operations in many parts of the world is due largely to the high basic rates necessitated by the high operating costs of current freighter aircraft. The aircraft concerned are, of course, largely DC-3 and DC-4s, backed up by Bristol Freighters and latterly DC-6As where the density of traffic permits their larger capacity.

The greater economy of the larger aircraft is, of course, well known; and in spite of the low depreciation costs and operating expenses of the DC-3, the profitability of the DC-4 (and the yet larger DC-6A) can be considerably greater than that of the smaller aircraft.

There has been a tendency for the larger aircraft to be designed for longer range and to be therefore less economic on medium and short stages. This can be critical in the freighting rôle and at present the most economic freighters, such as the DC-6 and Constellation conversions, have Atlantic range-capability which, with even the most favourable concessions on landing weight, must adversely affect their short-range profit potential.

The DC-3 is the most widely used freight aircraft in the world largely because it is of a size sufficient for most operators who could not hope to fly the DC-4 as a pure freighter with adequate loads and frequency. Again, more aircraft of a smaller size can be flown at a higher frequency. Important too is the ready availability of DC-3s on the market. The widely known and simple engineering features and low capital cost are attractive to the small operator and to the large operator of small regional services. These factors have established the demand and prolonged the life of the DC-3, but they do not deny the need for a replacement.

The relative operating costs of freighter aircraft are not easy to establish. The Air Research Bureau in their valuable study on Intra-European Air Cargo have quoted the following figures for the DC-3, DC-4 and DC-6. For comparison, we quote figures (in italics) for U.S. domestic operation of DC-3, DC-4 and DC-6 aircraft as provided by Mr. Dixon Speas in his recent book *Technical Factors in Air Transport Management*.

	Capacity (tonnes)	Direct cost (cents per tonne-km)
DC-3	3.2	17.2 (*9.9*)
DC-4	7.7	13.3 (*5.75*)
DC-6	12.6	8.7 (*4.78*)

These direct operating cost levels may be compared with freight rates in Europe and the U.S.A. Among the A.R.B. carriers (who, of course, operate to the rate-structure agreed through I.A.T.A.) the average freight rate is about twice the direct cost per capacity tonne-kilo of a DC-3. Comparable figures for U.S. domestic operations would be 12 to 14 cents per tonne-kilo and these reflect the more extensive use of DC-4 and DC-6 aircraft in the U.S.A. and smaller ratio of total costs to direct operating costs.

The reasons for the higher costs of European operations as compared with those of the U.S.A. need not be fully explored here. The major factors are probably the use of larger and more advanced aircraft in America operated more intensively on a pattern of routes which lend themselves to closer integration. Fuel costs are, of course, lower in the United States; on the other hand, labour costs are considerably higher, and the high productivity of man and machine is well shown in the greater output in ton-miles of transport product in the U.S.A. compared with the best achievements in Europe.

Airline opinion has differed considerably on the subject of convertible aircraft. Time lost and damage inflicted with the best conversions are frequently stated to outweigh the merits of the scheme as proven on paper. The best solutions seem to vary in each area, and the B.E.A. conditions which led to the Vickers Vanguard will not necessarily apply to operators elsewhere.

But seasonal, daily and weekly peaks of passenger traffic are one of the major problems confronting air transportation, especially in an area such as Europe, and the development of air freight services to provide a complementary utilization of the same aircraft has immense possibilities. In Europe the daily and weekly peaks of passenger traffic fit adequately into the "troughs" of air-cargo movement. However, at present, aircraft that can handle the loads (even if lower rates could attract them) are not available.

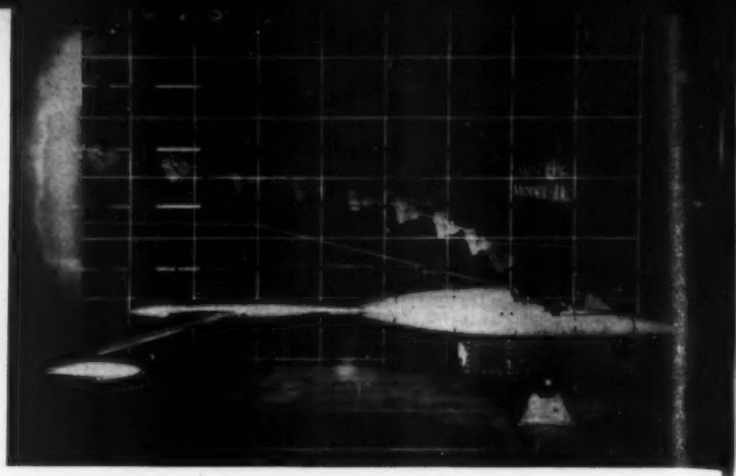
The one-way characteristic of most freight movement has often been quoted as a cause of the poor operating economy of air cargo services. It is true that it can be crippling if accepted at its face value, and if no steps are taken to fight it. The Air Research Bureau quote for their member-airlines in 1953 an average directional-load ratio of 35 : 65, and they have drawn attention to the need for a better balance to improve load factors. The problem was solved long ago by the tramp ship in the simplest possible way by what we should now call *ad hoc* as opposed to scheduled operation. This kind of work is easier to find in the U.S.A. than on the long chain typified by British Commonwealth air services.

Mr. Grabowsky, A.N.A.'s planning and development manager, spoke recently of this very problem in the organization of the Air Beef Scheme in the Northern Territories of Australia. By *ad hoc* freighting carcases from inland *abattoirs*, resulting in the improvement of properties, it is considered possible, he said, ultimately to achieve a 75 per cent load factor.

No major obstacle is in the path of air cargo's continued growth. The most important present task is the design and development of the optimum aircraft. Whether a reduction in specific direct costs of, say, 10 per cent would permit a rate-reduction of x per cent which would stimulate an n times x per cent increase in freight traffic may prove to be academic. There is an immense potential air movement to be performed, and only the most intense and imaginative effort now can provide aircraft adequate for the task in the years ahead.

(*To be concluded*)

The Lockheed C-130 is the most up-to-date all-cargo machine flying and, although the design is based on military requirements, its suitability for commercial operations is obvious. The general layout may be regarded as classic for the purpose of freighting.



A high-speed multiple-image photograph of the forward-facing "A" seat with skip-flow generator. The photograph was taken in the Southern California Co-operative wind tunnel with a specially developed camera.

Seats for the Century Series

—*of U.S.A.F. Fighters: Convair and Lockheed Developments*

UNDER the direction of the U.S. Industry Crew Escape Systems Committee, both Convair and Lockheed have been granted co-ordinating contracts for the development of ejection seats for the "Century" series supersonic fighters. Convair are developing an upward-escape system and Lockheed are working on a downward-ejection seat.

A major task is to protect the pilot from the fierce onslaught of the airstream immediately after ejection. For this purpose, Lockheed designed the skip-flow generator system, described in *Flight* for November 30, 1956, which relies on a small plate extended into the airstream ahead of the seat to cause an envelope of relatively slow-moving air to form round the pilot. The seat is stabilized by fins. Convair have taken up this device and applied it to an upward-ejection seat, which is also stabilized by means of fins.

Convair have also developed a seat which tips the pilot over on to his back at the moment of ejection and projects him feet-first into the airstream. Special harness and guards secure his feet and shield him from blast. Fins are also deployed to stabilize the seat in flight. The Talco RESCU rocket device, illustrated in *Flight* for November 23, 1956, is incorporated to give the seat added boost to clear the airframe at very high speeds or during ground-level ejection. This Convair seat, which has been mentioned in connection with the F-102 and F-106, is nicknamed "aerial bobsled."

Altogether, thirteen major aircraft companies are engaged in the ejection-seat development programme. Small-scale models of the Convair and Lockheed seats have so far been tested in the Southern California Co-operative wind tunnel; and full-scale blast and trajectory tests are soon to begin on the rocket sled installations at Edwards A.F.B. and Hurricane Mesa, Utah.

With the "aerial bobsled," officially known as the B-seat, the pulling of the firing ring between the pilot's thighs causes his feet to be drawn back by cords on to stirrups. The seat then rotates backwards while, at the same time, the stirrups are moved up and partly covered by streamlined fairings. The pilot's knees are thus brought firmly up to his chest. Another guard-plate emerges from each side of the seat to hold the pilot's knees in, and thereby to restrain his forearms. This whole process takes 0.25 sec.

The rotation of the seat begins only after it has travelled some 19in up the rails in a vertical attitude under the initial impulse of the ejection cartridge. Thereafter a scissor linkage effects the rotation. By the time the seat emerges fully from the cockpit the rotation is complete and total time of just under a second has elapsed. Horizontal and vertical stabilizing fins spread from the top (now aft) portion of the seat and a rocket charge takes over the task of propelling the pilot and seat forwards and upwards to clear the aircraft structure.

The Lockheed seat with the skip-flow generator plate is lighter than the B-seat and better suited to present cockpit layouts. The rotation process, of course, requires some clear space just aft of the normal seat position. But both seats are being taken to the rocket-sled test phase to ascertain their various characteristics. Both have shown stability better than that obtained with present U.S.A.F. ejection equipment.

In order to record the trajectory and behaviour of the new seats during small-scale model tests in wind tunnels, a special high-speed, multi-exposure camera was developed by Irving Jacobson, a Hollywood photographic engineer and consultant. The camera is remotely controlled and can make from ten to 2,000 exposures per second on a single sheet of film.

Northrop Aircraft, Inc., have developed a special rocket sled on which the B-seat will be tested at the A.R.D.C. Experimental Track Branch rail at Edwards A.F.B. Eight runs will also be made with the A-seat in various positions and at various speeds on the Mojave Desert track. Later, platform and cockpit ejection tests will be made at the SMART Track Facility at Hurricane Mesa. These tests will show what further modifications are needed before the final configuration is decided.

In both A- and B-seats the parachute is deployed by an aneroid capsule device, but no details have been given about the timing and method of separation of pilot from seat, or about the method for decelerating the pilot before opening the parachute. These operations may themselves be critical in many cases.

The following firms and factories are working on the escape system projects: Aircraft Mechanics, Inc.; Boeing Airplane Company, Washington and Kansas; Chance Vought Aircraft, Inc.; Coleman Engineering Company; Cook Research Laboratories; Douglas Aircraft Company, El Segundo, Long Beach and Santa Monica; Grumman Aircraft Engineering Corp.; Lockheed; the Martin Company; McDonnell Aircraft Corp.; North American Aviation, Inc., Los Angeles and Ohio; Northrop Aircraft, Inc.; Republic Aviation Corp.; Stanley Aviation Corp.; Talco Engineering Company; Temco Aircraft Corp.; Weber Aircraft Corp.; and Convair, San Diego and Fort Worth.

W. B. Harwell, manager of production flight for Convair, San Diego, demonstrates the rotation of the "B" seat. Foot positioning, thigh restraint and the extension of the stabilizing fins can be seen.

THE NEW R.A.F.

"No Need for Pessimism" the Keynote at Pathfinders' Annual Dinner

PRINCIPAL guests at the annual dinner of the Pathfinder Association, held at the Dorchester Hotel, London, last week, were the Under-Secretary of State for Air, Mr. C. I. Orr-Ewing, O.B.E., M.P., and the Deputy Chief of the Air Staff, Air Marshal Sir Geoffrey Tuttle, K.B.E., C.B., D.F.C. The president, A. Cdre. J. M. Birkin, C.B., D.S.O., O.B.E., D.F.C., A.F.C., was able to report favourably on the circumstances of the Association. In proposing "The Royal Air Force" in a humorous and well received speech, he said that the current position of the Service might be likened to that of Irish politics—it was desperate but not serious. He thought that people had taken an unduly pessimistic view in the light of the recent changes.

Replying, Sir Geoffrey Tuttle said that the re-alignment was not a sudden shock. Many of the changes—no new fighters, no supersonic bomber—followed the decisions made earlier this year by the Air Council. He went on to point out that only a small portion of the Air Force had ever flown, and that to reduce this small number by a further small proportion would not affect many people. The Service would still use aircraft and engines, and the bulk of its manpower would be unaffected. There would be plenty of flying for the next ten years and the result of the reduction in flying strength would be a raising of the standards: it would be difficult for a man to get in as a pilot, and there would be plenty of room for those good enough to meet the new high standards.

The Air Marshal went on to say that though there would be no Pathfinder Force in the future, "Pathfinder qualities" were needed still. In discussing the reduction in fighter strength, people overlooked the fact that Bomber Command would get bigger and bigger. We had to go on finding ways of preventing war, and in some rôles there would be unmanned methods of delivery. Transport and Coastal Commands, also, would continue. Airmen developed three-dimensional minds and it was important to continue to think in these terms, because the rôle of the Air Force was unaltered whether an individual flew or not.

The health of the guests was entertainingly proposed by Mr. Kenneth Wolstenholme, D.F.C., and Mr. Orr-Ewing replied. After some lighter remarks he said that a new chapter was starting in the R.A.F., but there was something still to be learned from P.F.F. principles. All men were not equally able or experienced, so it was better to concentrate, and lead the less able and less experienced. This was one lesson; the second was that one could not provide the whole of a massive Air Force with the latest gadgets and equipment, so one should concentrate the best men and the best equipment. There would never be mass bomber raids again, but today one bomber packed the punch of the whole front line of the Air Force of the last war; so each of the bombers we did have must be the best and the best manned. The third lesson was that the P.F.F. used "the guts, brains and operational experience of the best crews and teamed them up with the finest scientific brains"; the keynote of the future in the R.A.F. would be the teaming-up of the General Duties and Technical branches.

Mr. Orr-Ewing went on to stress that though "Guided weapons will nibble at only one command in the next five years," all the rest of the commands would expand. Defence could not be left solely to electronics while they could be jammed. Perhaps the only kind of war we should have to face for years to come would be the cold war, and this would need pilots on and on for years. If our deterrent policies were effective, there would even be several decades of pilots in the R.A.F.

FOR THE BOOKSHELF

"Best Foot Forward," by Colin Hodgkinson. Odhams Press, Ltd., Long Acre, London, W.C.2. Illustrated. Price 18s.

IN 1939, as a midshipman accepted for the Fleet Air Arm, Colin Hodgkinson was doing his sea training. To all appearances a typically hearty rugger-playing, boxing, tankard-emptying six-footer, he was yet curiously introspective: so much so that as he began his flying training he found himself doubting whether he wanted to fly at all, and admitting to "a lack of confidence in my ability to control machines."

As tuition at Gravesend progressed, he met his particular *bête noire*—instrument flying. As soon as the hood was drawn over the pupil's cockpit in the Tiger Moth "I lost my wits completely. . . . My faculties were frozen in the fuzzy panic of claustrophobia." His instructor was worried: "It won't do, old boy. We'll have to get this buttoned up."

It was during the buttoning-up process—an extra session under the hood—that Hodgkinson's aircraft collided with another and spun in from 500ft. He awoke in hospital to find himself minus his right leg; and after long agonizing months his left was amputated also.

During this time he read about Douglas Bader: "It seemed as if he loved the air; I hated it. . . . If Bader could fly, I told myself, so could Hodgkinson. By a process of counter-irritation I worked myself into a state of arrogance. The air owed me a living. It had made me in my own eyes less than a man. I would make it the instrument of my becoming one. I loathed it; I would make it serve me."

There followed "tin legs" at Roehampton, a facial operation by Sir Archibald McIndoe at East Grinstead, and invaliding out; then a long spell of string-pulling that at last got him back into the F.A.A. and, eventually, into a cockpit.

Recoiling from being relegated to "dragging a drogue through the sad skies of St. Merryn," he achieved a transfer to the R.A.F., and eventually to a Spitfire squadron, No. 610, under the great Johnnie Johnson, then to No. 611, at Biggin Hill, with Spitfire 9s.

The succeeding chapters of Mr. Hodgkinson's book contain taut and vivid descriptions of fighter, escort and ground-attack operations. Yet, after a hundred sorties and several victories he still regarded flying as an enemy in its own right; and when he was on a lone met. flight over France it struck at him again, this time in the shape of an oxygen failure at 31,000ft. Once more he awoke in hospital, this time as a prisoner of war.

There followed other hospitals; prison camps; repatriation; more string-pulling; and eventually, for this unquenchable spirit, a fighter-leader course at C.F.E. just as the war was ending. Then demobilization, and "idleness and boredom that induced me to explore the shifting, twilight world of spivvery." Finally, back to the old enemy for week-ends—as a pilot in No. 604 Squadron, R.Aux.A.F.—and eventually to a rewarding job and a happy marriage.

Particularly in the early chapters there is what strikes one as an unnecessary lack of reticence about matters concerning the author's parental family; but some of these allusions are admittedly relevant in that they explain his complex personality and contradictory attitude to flying and fighting. Altogether, a highly readable autobiography.

"Aircraft of the Royal Air Force 1918-57," by Owen Thetford, Putnam and Co., Ltd., 42 Great Russell Street, London, W.C.1. Illustrated. Price £2 10s.

CONSIDERED as a general view of 1918-57 R.A.F. equipment, Mr. Thetford's book is a welcome and attractive accession to the aeronautical library. But as a detailed study for the enthusiast or specialist it has frequent deficiencies and inaccuracies, and hardly makes good its claim to be an encyclopædia (not, at least, in the sense that J. M. Bruce's articles are encyclopædic).

It is, as we say, an attractive volume, page-size 5½in × 8½in, printed on 528 glossy pages, with nearly 200 three-view line drawings and considerably more than that number of high-quality photographs, including some hitherto unpublished. Every type of machine which has operated in normal R.A.F. service is dealt with; and for good measure there are special record-breakers which have borne R.A.F. roundels, such as the Fairey Long Range monoplanes and the various Schneider Cup seaplanes. Especially valuable are the notes concerning quantities built and squadrons equipped.

Almost immediately on opening the book, however, the fastidious reader receives a minor shock on beholding Mr. L. E. Bradford's drawing of an alleged "Siskin III." The most superficial comparison with adjacent photographs will show that, in respect of fuselage design especially, this mark of Siskin was a very different aeroplane from the Mk IIIA, which the artist appears to have taken as the basis of his drawing. His rendering of a Vimy with *geared* Jupiters may have stemmed from a similar error in adapting an existing drawing; and there are several drawings of similar dubiety. Some of Mr. Thetford's statements, too, are either questionable or positively incorrect (e.g., that the Gamecock was the last fighter of wooden construction to serve with the R.A.F.). Nevertheless, we welcome his book as one which, its frequent defects notwithstanding, will give a great deal of pleasure and a considerable amount of factual information.

COMET TO KANO

The R.A.F.'s Jet Transport Shows the Flag in Africa

"FLIGHT" PHOTOGRAPHS

Four of Transport Command's Comet T.2s and C.2s at their Lyneham base. No. 216 Squadron's Comet fleet and crews are now almost up to operational strength.

THE road journey by elderly motorbus to R.A.F. Clyffe Pypard, the air trooping centre for No. 216 Squadron, Transport Command, Lyneham, would have been an appropriate prelude to a flight in a Valentia. In fact our rattling, backfiring ride through the Wiltshire country lanes was the prelude to a flight in the smoothest, most up-to-date air force transport of all, the Comet.

Next morning, within 30 seconds of the appointed time, our Comet was thrusting smoothly away from the dismal English weather *en route* for the tropical climate of Nigeria. It had been ordained by the Colonial Secretary that the R.A.F. should show the flag at the opening on May 4 of Kano's new air terminal (see page 677). Word to this effect had been passed from the Air Ministry to Transport Command and Bomber Command: and accordingly Comet XK679, carrying ground-crew and stores for a Valiant B.1 of 90 Squadron (due to follow from Honington) and with *Flight's* representative on board, was on its way to Nigeria.

Our first stop was to be Nicosia, a deviation from the direct route to Kano made in order to deliver some airmen to Cyprus, and also to enable Air Chief Marshal Sir John Whitworth Jones, G.B.E., K.C.B., to attend the presentation of a Standard to his old squadron, No. 13, now based at Akrotiri.

S/L. G. C. McCarthy, M.V.O., A.F.C., formerly of the Queen's Flight and in command of our two crews, was captain on the first leg. Our course was *via* Nice and Sicily, a roundabout (300 miles longer) route chosen to avoid the Balkans, and to ride into Cyprus on a south-westerly jet stream forecast at 40,000ft over Sicily.

The 2,044 n.m. flight was conducted, like all R.A.F. Comet operations, strictly to airline procedure (as described later). The flight plan had called for 51,000 lb of fuel, which with a 7,800 lb payload and a 58,400 lb basic weight had required a take-off weight of 117,200 lb.

Our Comet was a C.2, of which Transport Command are to have eight; de Havilland have now delivered six in addition to the two T.2s last June, which were the first Comets to be handed over to the R.A.F. The C.2's interior has been described before, and suffice it to recall that it differs from the T.2—which is virtually of B.O.A.C. standard in equipment and furniture—in that it has Ekco search radar; a strengthened forward cabin floor for freight; a fifth crew-position just aft of the flight deck for a signaller or radio officer and 32 backward-facing 15g four-abreast seats of the type fitted in the Beverley. In most other details the C.2 conforms to B.O.A.C. standards, from its curtains and carpets to the toilets and washrooms.

On flights such as this, it is possible, without feeling too anti-social (as one would on an airline flight) to wander about the aircraft. While this makes for a matey spirit among the passengers, it can become a little trying to the crew, in particular to a Comet crew which is operating with more than the customary amount of concentration and precision. At the top of the cruise particularly, at 42,000 to 43,000ft, even the rock-like stability of the Comet—and the patience of the "George-watcher"—can be sorely tested by the to-and-fro trampings of hefty Servicemen.

An hour and a half after take-off we were invited up front by the captain. "If the met. people are right we should be hitting our jet stream very soon," he remarked. Barely a minute later we felt the cobblestone bumps, so familiar to jet crews, which meant that we were running into one of those currents of fast-moving air (in this instance providing a 30 kt tailwind component) which inhabit the stratosphere. No adjustments were made to power-settings, and we continued a steady cruise-climb at Mach 0.73 indicated, the Avons turning steadily at the 7,400 r.p.m. selected for the outside air temperature of −34 deg C. We were burning off fuel at a steady 6,800 lb per hour according to the flowmeters on the engineer's panel.

Though R.A.F. Transport Command are not in the operating business to make money, our Comet crews appeared to take immense professional pride in operating strictly to the book (the A.R.B. Flight Manual), and as if every ounce of fuel mattered. For instance, on the next sector, a short 500-mile hop to the R.A.F. base at El Adem, Tobruk, we arrived overhead a few hundred pounds heavier than the 84,000 lb max. landing weight, and had to spend a few minutes orbiting to burn off fuel. No one appeared to mind—except for the navigator, who had done the flight planning, and who seemed rather displeased. Again, on the next leg, the captain of the second crew we had on board told us, with unconcealed pleasure, how his navigator had instructed him to begin the descent into Kano within a few seconds of the correct moment. As a result, having chopped back the inners to idling and the outers to maintain 220 kt, he had arrived 1,000ft overhead on the downwind leg without having once touched the throttles or the air brakes during the descent.

Tarmac temperature at Kano was 153 deg F, but the four-wheel bogies caused no harm to the apron that a roller could not put right. One of the flight engineers had a private ("unofficial") theory that if the Comet was left standing in such heat with empty tanks, the seals round the pipes into the integral fuel bays might harden and cause subsequent leaks. (This had happened once at Singapore.) So he had put 1,200 gal in the tanks: "There's

Left, P/O. R. Wilding, in command, with F/O. A. Huggert as co-pilot. Right, the signaller's station aft of the flight deck—a new Comet crew-station peculiar to the R.A.F.'s C.2s. The R.A.F. operate their Comets with a crew of five.

Left, freight and spares in the forward section of the Comet, the floor of which is strengthened for this purpose. Right, R.A.F. airmen in the Comet's 32 backward-facing 15g chairs. Of standard Transport Command pattern, they are interchangeable with airline seats.

nothing to lose, and anyway just imagine trying to work inside that wing in this heat." He didn't reckon he would live five minutes, even with oxygen.

We used about two-thirds of Kano's 8,610ft runway on take-off next day, unsticking at 120 kt at a take-off weight of 104,500 lb, and climbed up over the Sahara towards Idris, 1,300 miles away, at the standard speed of 230 kt indicated. For 3½ hours we cruised without a tremor, over the great Sahara's waste, and we remembered the "poised motionless in space" catchphrase of the early Comet 1 days.

Soon after the beginning of the descent into Idris—a moment betrayed by an almost imperceptible deceleration and a barely audible wail from the inners as they were throttled back—the captain was warned by Idris tower of the presence on the runway of a large swarm of locusts which was being pursued by birds. The captain, having asked for provisional clearance to divert to the U.S.A.F. base at Wheelus, a few miles to the east, decided first to orbit at 20,000ft over Idris. The runway and approaches appeared to be clear: from that height they would not have done had the swarm been impenetrable, and it was decided to make a run-in. Although flying in V.M.C., we followed the ordained A.T.C. procedure for the let-down from 20,000ft, involving a descent down the 14-mile safety lane to 5,000ft, a one-eighty turn, and a long, low approach on D.M.E. It all seemed, as we roared low down through the hot bumpy desert air, to be an unnecessary waste of time and fuel: but there were rules to be conformed to.

We found ourselves musing similarly on the final leg home. We had been at 43,000ft over Abbeville (the highest point reached on the trip) and were entering the London F.I.R. *via* Amber Two. We were over the Channel in V.M.C. conditions, with not an aircraft to be seen or likely to be seen anywhere. But we obediently turned over the Rye non-directional beacon on to Blue Three, and headed towards Lyneham through the London control zone. It later transpired that the let-down had been delayed by London Radar, who were unable to ascertain the height of a light twin which was somewhere in our area—even though it was probably 20,000ft below us.

The Comet had flown us about 6,000 miles. The only snag which our flight engineer could report was that the cable to his desk-lamp had come adrift.

Although one would expect the R.A.F. to be proud of its Comets, Transport Command's enthusiasm for the aircraft has to be experienced at first-hand to be appreciated. Twenty-four highly-trained Comet crews are now on the strength, and 216 Squadron is working them all hard. The three-day service to Singapore and back takes six crews, and a regular Comet service to Woomera, Australia, is due to start soon.

The Comet is the only jet airliner in air force service, and Transport Command now concedes nothing in the quality of its equipment or in efficiency to any air force transport service in the world. This is a change from the past, and a good foundation for the R.A.F.'s greater strategic transport responsibilities of the future.

J.M.R.

Flight Planning. The R.A.F. operates its Comets strictly to airline procedure. Flight-planning is the responsibility of the navigator, who has a lot to do—usually unaided—during turn-rounds. (He is also the busiest crew-member during flight.) The procedure conforms in principle to that followed by B.O.A.C. and other operators of the Comet 1 (and which was later adapted to the Britannia).

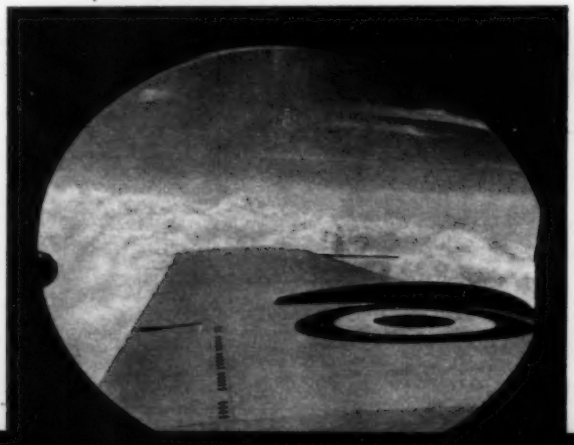
The navigator first refers to the "minimum sector fuel," a quantity calculated for every route, and which takes into account average winds and temperatures experienced on that route. Minimum sector fuel includes (1) flight-plan fuel, plus 6½ per cent for contingencies; (2) a fixed landing-reserve of 5,500 lb (the R.A.F., unlike B.O.A.C., work in lb rather than kg); (3) diversion fuel, which varies according to the sector (and which itself includes detailed allowances); and (4) taxi and unusable fuel amounting to 1,050 lb. Minimum sector-fuel may of course be exceeded, and on the majority of occasions has to be; but it may not be reduced.

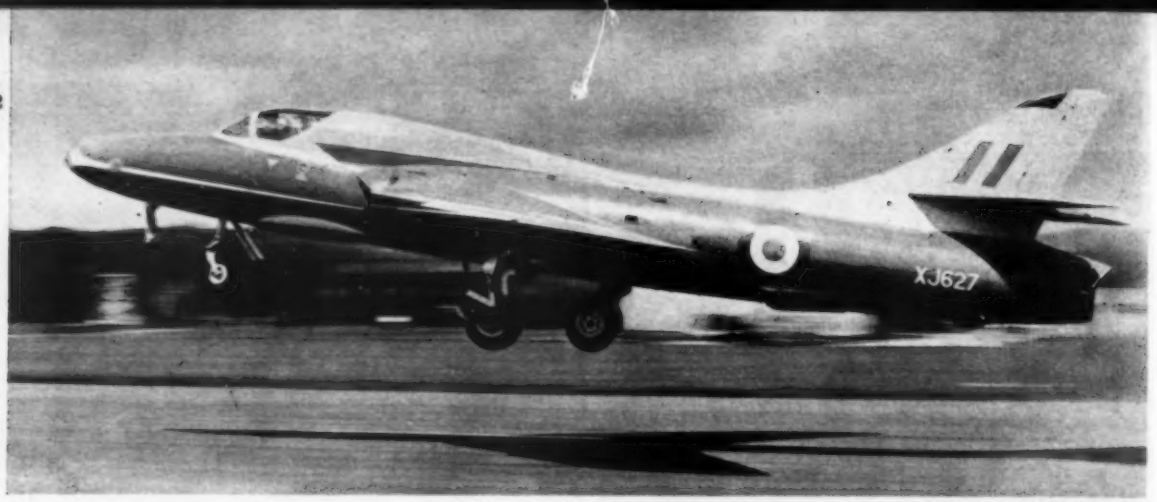
While "min sector" is being put in the tanks to speed the turn-round the navigator checks *en route* winds and temperatures with the met. department. Using D.H. "Rapid Flight Planning Charts," a streamlined pictorial presentation of the tabulated figures used for the Comet 1, he reads off exact flight-plan fuel for climb, cruise and descent, thus seeing whether he is covered by "min sector". If not, then the difference is added. Finally, take-off weight (120,000 max), which is the sum of payload, basic weight and total sector fuel, has to be referred to separate graphs calculated for each airport and which show required weight limitations, which appear to be remarkably few for the Comet 2.

Before the flight the navigator plots a Howgozit chart, showing estimated fuel-remaining against distance-to-go, checking in flight the actual fuel position with the engineer at half-hourly intervals.

An R.A.F. Regiment airman, who was one of a company flown by Comets to Cyprus, guards Hunter 6s at Nicosia.

"We cruised without a tremor, and remembered the old Comet catch-phrase about being poised motionless in space."





"Flight" photograph

HANDLING THE HUNTER

Supersonic Experience with the Two Seater

By C. M. LAMBERT

IMAGINE an engine so powerful that it will move its aircraft forwards on the ground with both main wheels firmly locked. Think of an acceleration on take-off that slams you in the back and makes you want to hang on to your hat. Imagine a roll so fast that it makes you giddy and leaves you feeling that you are flying sideways when it is over. Imagine an aircraft with finger-light control at all speeds and no Mach characteristics. Dream of an air-conditioning system that is completely steady and stable from Mach 0.9 at 45,000ft to over 600 kt on the deck. Imagine all this with a touchdown speed of about 110 kt. That is the Hunter 6—and the second prototype of the Hunter Two-Seater which I flew last Friday. I found that the combination of electric tailplane-incidence change linked with the fully-powered elevator and a "saw-tooth" extended leading edge have given precise fore-and-aft control in the dive past Mach 1 and a turning performance that is virtually pitch-up proof.

During several years as a member of an Auxiliary fighter squadron I had piled up just over 500 hours in Meteors. When our neighbouring regular squadron was re-equipped with Hunters the Auxiliaries stood by hungrily waiting for a chance to fly them. A number of pilots did get this chance; and their reaction to their first Hunter trip was one of tremendous enthusiasm. The machine, they found, offered a very great improvement in performance without any additional complication or difficulty in handling. Their first trip was made after a thorough perusal of the Pilot's Notes and a spell in the cockpit to get the hang of the switches and dials.

New Hunter pilots often said that the main impression of the first flight was that of struggling to keep up mentally with the aircraft all the way to about 35,000ft. Almost before they were over their surprise at the acceleration on take-off the aircraft was airborne. Then the wheels had to be retracted, and already the climbing speed was on the clock. They pulled the nose up and up to hold the climbing speed; and no sooner had this stabilized than the 5,000-ft mark was past and the first reduction in speed for the climb was called for. There was no let-up until they were back in the circuit, but the landing was perfectly normal and presented no difficulties. Here at last was an aircraft which would catch anything in the English skies, including the elusive Canberra; and it had all the performance an Auxiliary dreamed of during mid-week days at an office desk.

I was not high enough in the queue to get a trip in a Hunter before the R.Aux.A.F. was disbanded and I therefore jumped at an opportunity, offered by Hawkers, of flying the second Hunter Two Seater. This particular machine is, in fact, based on the Hunter 6 and has the big "10,000 lb-thrust class" Rolls-Royce Avon of the fighter. Its performance is virtually the same; and for that reason the specially drafted security clearance covering my flight stipulated that I was not to be shown the limits of the Two Seater's performance. The quantitative information included in the following report is therefore a guide to the characteristics of the machine and does not represent maximum capabilities.

The R.A.F. and the Royal Navy have ordered the earlier Hunter Two Seater based on the Mk 4 fighter, which has a slightly less powerful Avon. It will carry a single Aden 30 mm cannon in one of the gun bulges. The Dutch and Danish air forces have also ordered Two Seaters.

The second prototype Two Seater, equivalent to the Mk 6 fighter, is finished in a splendid blue and pale grey colour scheme and looks nothing if not purposeful. It has, in addition to the side-by-side two-seat cabin and large hump behind it, a fairing for a drag parachute above the tail-pipe and saw-tooth leading-edge extensions. This last is a modification which is being added to many of the Hunters already produced, as well as to all new aircraft of the *marque*; and it has the effect of virtually eliminating pitch-up and slightly improving the stall. The horizontal tail control is also much more powerful, for the early boosted elevator has been replaced by a fully powered elevator and electrical follow-up of the tailplane. This is so arranged that, after 2 deg of elevator movement micro-switches are contacted to change the tailplane incidence at the rate of 0.7 deg/sec. This has the effect of an "all-flying" tail, but small adjustments remain free from tailplane follow-up, making fine control during formation flying very much easier. Response during pronounced manœuvering, or at very high Mach numbers, is excellent. The only feel in the tail is a non-linear spring giving a centring indication and quite a light load at full deflection. The ailerons are fully powered, with very slight spring centring; and the rudder is purely manual. Tailplane incidence range is $+3\frac{1}{4}$ deg to -2 deg. Tail trimming is by control of the tailplane from a sliding switch in the top of the control column.

Hydraulic actuation is used for flaps, undercarriage, air-brake and wheel brakes. Flap control is through a small lever with which the desired flap position is selected against a scale. Undercarriage operation is by push-buttons, with an override on the "up" button for retraction on the ground in emergencies and a stand-by lowering system. Air brake is selected from a spring-loaded switch in the end of the power lever, where also there is the "press-to-transmit" switch. The power lever is tilted almost vertically and has a twist-grip for manual ranging of the gun-sight, though this latter normally has radar-ranging control.

The author and Bill Bedford, Hawker chief test pilot, preparing to get airborne in the Hunter Two Seater at Dunsfold. Above, the machine unsticks after an acceleration-packed 700 yd ground run.

"Flight" photograph

Hawkers state that the engine handling of the large Avon is unsurpassed by that of any other engine in the world. The power lever can be slammed open, closed and slammed open again at stalling speed near 50,000ft without protest from the engine. Power comes immediately and there is no risk of flame-out. Having been brought up on the directly linked power levers of rather earlier turbojets I could not bring myself to put all this to the test, but was assured that it was indeed so. Another feature of the big Avon is its iso-propyl-nitrate turbine starter which, with a tremendous smokeless hissing, spins the engine up to self-sustaining r.p.m. a good deal more quickly than did the earlier cartridge. The propellant-tank holds sufficient for three starts.

I flew the Hunter with A. W. ("Bill") Bedford, Hawker chief test pilot, from the company airfield at Dunsfold. The first task was to equip me with a flying suit, cloth inner helmet and "bone dome." A pressure-breathing oxygen mask was attached to the helmet by a toggle frame instead of the usual straps, so that it could be very quickly clipped into place over one's face by snapping the over-centre linkage, much like the stopper of a pop-bottle. A second small toggle link could be snapped down to clamp the mask very tightly to the face in case of cockpit-pressurization failure and consequent need for full pressure-breathing. In view of the fact that I was not to be fitted with a g-suit, Bill did not wear his.

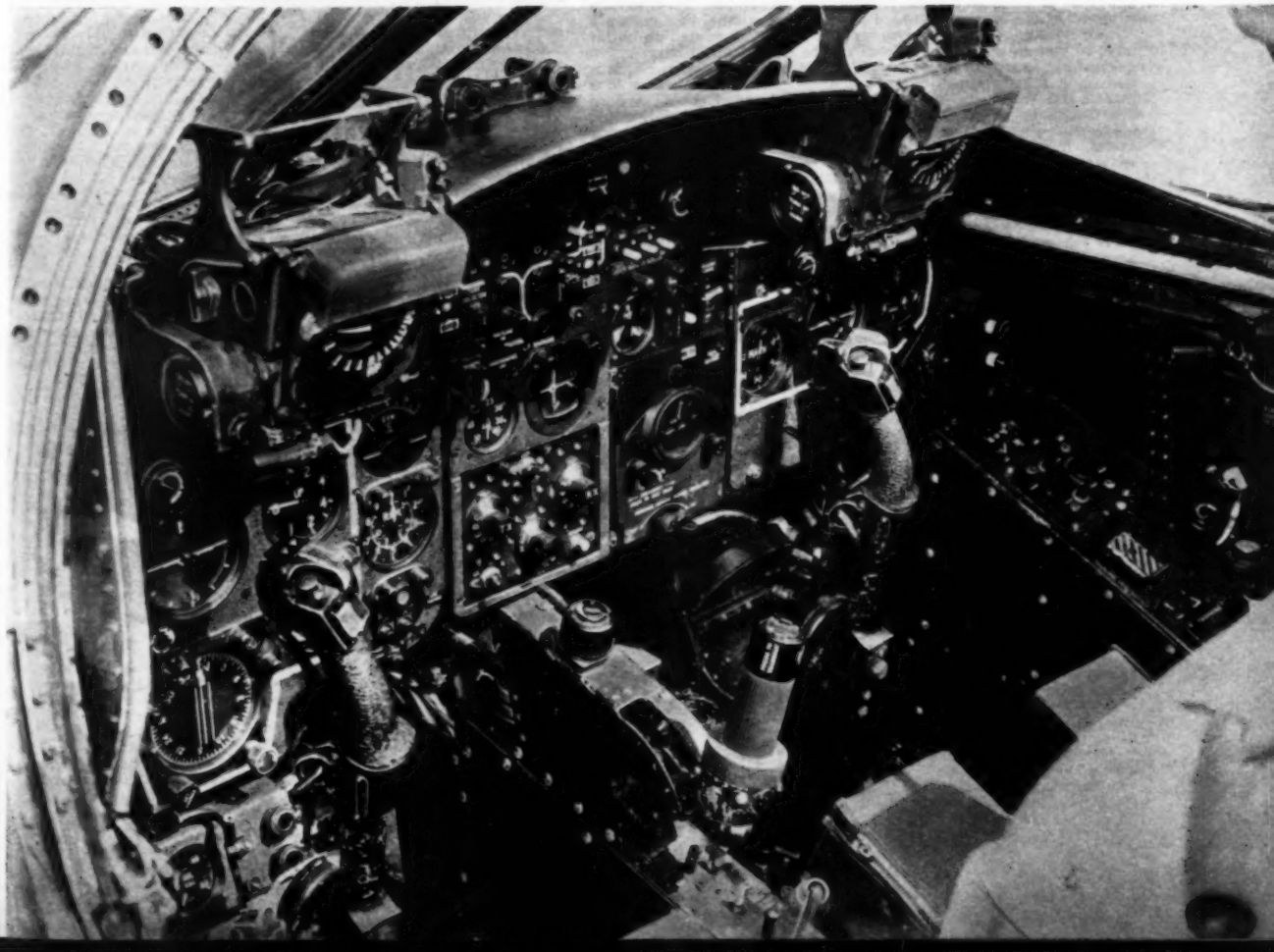
We climbed into the aircraft and started the long business of strapping in. The ejector seats are of the Martin-Baker Mk 4 lightweight, fully automatic pattern. Hood jettison and seat ejection are both operated either by the main firing handle above the head or by the alternative trigger between the legs. Leg restraining harness is fitted and has to be threaded through rings in straps fastened to each leg just below the knee. Bill's suit had these straps "built in." The ground-level ejection timing device is fitted. Both parachute and seat harness can be instantly adjusted for length. All this is according to the latest practice.

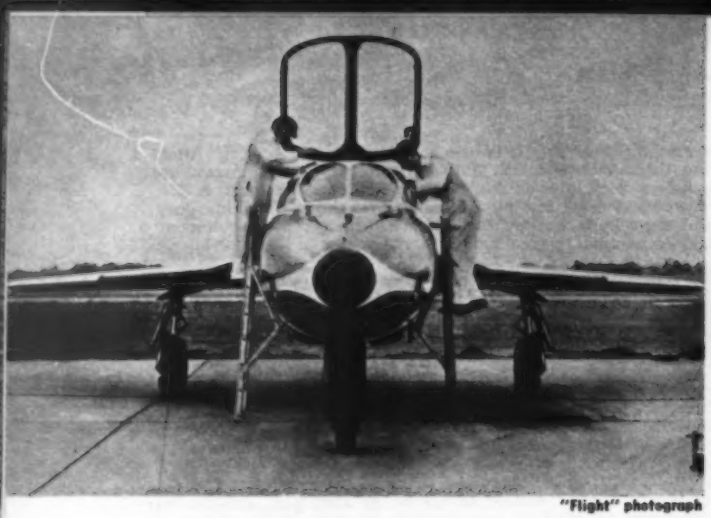
In case the automatic devices do not work after ejection, the drill is to pull the first of two D-rings on the parachute harness to free the parachute from the automatic release devices. After that the pilot can detach himself completely from the seat by pulling a small lever on the left of the seat pan. This drill is also recommended for leaving the aircraft quickly if anything goes wrong on the ground below 120 kt. All this excellent equipment takes some time to fit up, but it does provide great confidence in case of emergency.

Final harnessing operations were the plugging-in of the short "pigtail" intercom lead and connection of main and bale-out oxygen tubes. The main oxygen system was in the American style and remained wired in the "on" position at all times. Oxygen mixed with air was delivered only when I breathed in, and a "blinker" showed on the panel each time I did so. At first this was disconcerting. I breathed, the blinker blinked. I stopped breathing and scanned the panel to see what had caused the movement. Finding nothing, I returned to flying—and once more stopped breathing as soon as the signal caught my eye again. It took me some time to realize what was going on. At high altitude, too, I found that I had to inhale and exhale consciously, especially when I wanted to speak. At very high altitudes an effort was required to force enough air through the throat to work the vocal cords.

But to return to the preliminaries. Having fastened all the many connections, I looked round the cockpit. It was surprisingly spacious. A narrow control-console separates the two pilots and leaves them well apart. Power levers, undercarriage and flap controls are duplicated, but otherwise the main equipment is concentrated on the left (pupil's) side of the cockpit. In fact, on that side everything has been done to reproduce the single-seater cockpit faithfully. The instructor has his gun-sight, altimeter, horizon, A.S.I. and Mach meter, but little else. The single-seater starboard console is reproduced in the centre of the panel and dominated by a diagram of the fuel system in which doll's eyes show the direction of flow for which each fuel valve is set. This is surmounted by two fuel-gauges showing the combined contents of the several tanks in fuselage and wing on each side.

The cockpit of the second Hunter Two Seater, which is equivalent in power and performance to the Hunter 6. The single-seater's cockpit is reproduced for a pupil seated on the left, with the starboard console re-positioned in the centre of the vertical panel. The instructor has basic flying instruments and his own power lever in the centre. Fuel-system indicators, in diagrammatic layout, oxygen demand regulator, D.M.E. control panel and an I.L.S.-type cross-pointer are in the centre of the panel. The ejector seats are Martin-Baker Mk 4 lightweight, fully automatic units with ground-level ejection device. Aileron spring-bias is applied with a gnurled wheel on the control column. The gun-sights, which do not retract, include radar-ranging. Starting controls are on the panel between the pupil pilot's legs. "Flight" photograph





"Flight" photograph

Two groundcrewmen help the pilots strap in. Two access ladders attach to the cockpit flanks and the canopy is power-operated.

HANDLING THE HUNTER . . .

Normally, fuel sequencing and balancing is automatic, but when the valves are switched for direct transfer control, the gauges show the fuel quantity of the tank being transferred at any one time. I noted that total internal capacity was 1,600 lb on each side.

The air-conditioning system has three controls. A rheostat is used to select a given temperature. A lever allows selection of increasing heat or cold; and a switch is marked for "auto" or "flood flow." The latter setting brings a great torrent of hot air through the demisting system to cope with heavy misting during rapid descents into warm, damp conditions. The whole system worked really well. Though not specially dressed I was never too hot or cold.

The fuel low-pressure cock is well out of the way and is generally left in the on position, while the high-pressure cock is incorporated in the first few inches of power lever movement and protected by a safety catch. A small console extending down between the pilot's feet, and carrying a few gauges and the starting controls, is not duplicated in the instructor's position. In most fighters, several services—such as pitot-head heater, gun camera, instruments and compass system—are normally switched on by the pilot when starting up. In the Hunter, these switches are grouped together and covered with a bar, a single movement of which turns them all on at once. Next to them is the starter button. The starting drill is, therefore, to take the power lever out of the h.p. cock section into the power section, move the switch-bar, press the starter, wait for about 15 seconds while everything spins up, and taxi away. The total time required in practice is something like 20 sec. Pilots already strapped in can leave the ground about half a minute after getting a scramble order. All modern gyro instruments are set to spin-up in this time, so that an instrument take-off can be made immediately.

The large canopy of the Hunter Two Seater is power-operated. It is also quite a hefty structure and could do considerable damage to a human arm which got in the way when it slammed down. A horn therefore blows rather alarmingly all the time the hood is closing and only stops when a small green light comes on to indicate that it is locked. In accordance with modern practice, all switches in the Hunter are arranged to be "up" for the "on" position.

Powered controls are engaged by switching on the aileron system and throwing the stick hard over to each side, and then by switching on the elevator system and again firmly exercising the stick. Doll's-eye indicators turn black when engagement is effected, but it can also be positively felt when moving the stick. With present wiring systems it is impossible to engage or disengage one aileron only. Lights indicate a drop in hydraulic pressure and two buttons are provided for emergency disconnection of the two power systems.

Power can also be switched off normally and turned on again for practising flying in manual control. Forces are then very heavy, since none of the control surfaces is balanced for manual operation. To ease the ailerons, the gearing is automatically halved in manual, making full stick-movement apply only half aileron-travel. This is sufficient for control and makes the very heavy loads rather easier to apply. In the manual-elevator case the tailplane follow-up is retained and the trimming facility is always available. If this too fails (so far, apparently, there have been no such cases) the task would be very hard, but not impossible.

All this background has taken a great deal longer to describe than I had to take it in. We got under way very quickly after strapping in, steering with the brakes along the taxiway to the westerly runway. There Bill Bedford called for take-off clearance and lined up. He opened the throttle against the brakes and I waited expectantly for the shove. When it came it was sudden and urgently powerful. I have never known such ruthless acceleration. After soaring up several thousand feet, we levelled out for a moment to build up our 530 kt climbing speed and then headed on past a few cumulus clouds into the bright upper sunlight. The nosewheel rumbled for a while after take-off till it slowed down, and then all was gentle hissing and deceptive calm.

I took over and started watching the climbing speed, since precision is the key to climbing performance in the Hunter—even more so than in the Meteor. The ailerons were extremely light and I progressed upwards with a pronounced lateral rocking which I found it very difficult to check. This was partly because I was not accustomed to powered ailerons and partly because it is a characteristic of some individual Hunters. Even when I did get the wings steady, the rocking was inclined to start again quite soon.

Though the climb looked little steeper than that of the Meteor, we were really going up. The V.S.I. was jammed against the stop until over 30,000ft and was still registering 3,000ft/min at 38.000ft. Less than full power was set. We passed 42,000ft just seven minutes after releasing the brakes, still rocking a good deal laterally and beginning to notice that a slight increase in Mach number resulted in a marked reduction in rate of climb. Very precise control was required at 47,000ft, which was the highest I went. By this time we were level with Poole Harbour and could see the Isle of Wight, tiny below us in a shimmering sea. The coast stretched away towards Dungeness under a patchy cloud layer, and another cloud-edge marked the French coast clearly from Cherbourg almost to Calais.

At 0.9 Mach the V.S.I. now showed that we were descending slowly. Speed built up with surprising rapidity to 0.95 Mach, at which point a nose-up trim change occurred. It was very easily held, for only the spring feel had to be overcome in moving the stick to its new forward position. It was a comfortable push—not the two-handed heave required in the Meteor at 0.77 Mach.

I applied 30 deg of bank and obtained a Rate one-third turn. Maintaining it, we turned very slowly towards the Isle of Wight while I tried to keep a constant Mach number and fluctuated between 44,000 and 46,000ft. Very precise control was needed. I steepened the bank to 60 deg, pulled 1g and obtained a Rate three-quarter turn, but gained 2,000ft with a slight decrease in speed.

Bedford took over and showed that, maintaining 0.9 Mach in a gentle descent, it was possible to pull something like 2g. We decided it was time to "plant one" (make a sonic boom) out to sea. Heading for the Channel east of the island I eased the nose down and watched the Machmeter. I wondered what would happen, but nothing did. The Machmeter simply went up to Mach 1 (Mach 0.98 indicated is Mach 1 true), and that was all. I moved the stick about and obtained precise response laterally and longitudinally, feeling that the aircraft would make a good gun-platform at this difficult speed. At about 30,000ft, I pulled about 4g before any buffeting occurred. There was no pitch-up.

We then sailed effortlessly back to 40,000ft and Bill turned the Two Seater smartly on to its back, pulled down into a steep dive and rolled level again. The speed built up rapidly and we were very soon up to Mach 1.03 indicated—not the maximum available. Pulling out above 20,000ft, we were below Mach 1 again by the time the nose passed the horizon. At no time was there any special noise or other indication of high speed other than the forward movement of the stick at 0.95 Mach. The follow-up tailplane makes handling at these speeds straightforward.

At the top of the initial climb we had had 1,050 lb of fuel left on each side and we now had 700 lb each side. Time was getting a little short, and Bill demonstrated the stall. At 0.9 Mach he extended the air brake, then the flaps at 330 kt I.A.S.; and we reached 200 kt after 32 sec. He continued to slow down until, with the aircraft clean again at 140 kt, a gentle buffeting began. Just before the stall the nose came firmly up, but could be held, and the stall followed at 110 kt. The nose dropped gently and straight, and recovery was quick and straightforward. We had now been airborne for 23 minutes.

A steep dive from about 20,000ft brought us into a level high-speed run 100ft up off the south coast. The speed built up steadily to over 600 kt indicated. The ground was really tearing by and the small resorts west of Brighton passed like a travelogue run wild. A 3g pull-up to 5,000ft was followed by a series of maximum-rate rolls at 350 kt. They were so fast that I was very giddy after four of them and felt that we were flying sideways when they were over—apparently a common reaction. They were so fast that through the roof I could watch an object on the ground almost continuously. Bill then executed a smooth, gentle loop, starting at 380 kt and getting over the top at 160 kt on half power.

Docility in the Circuit

We returned to Dunsfold and landed, touching down at a very sedate 110 kt, with 800 lb fuel left. At the end of the runway we turned round and Bill let me do a circuit. I lined up and opened the throttle till I could feel the Hunter creep forward despite full brake. I let the brakes off and was slammed back in the seat by the fantastic acceleration. Quick jabs of brake kept us straight (the Hunter was weathercocking in a cross-wind) as the scenery began to tear towards us. At about 80 kt there came a distinct feeling of aerodynamic control and I eased the nose up. Almost straight away the machine was off and soaring upwards. Until one grows accustomed to it, the take-off really is a brief spasm of desperate concentration between rest and flying.

We left the wheels down and throttled back straight away to stop the speed building up and thus save fuel, which was now becoming a little precious. At 1,000ft I flew the down-wind leg, reducing speed and asking for the flaps to be lowered at 230 kt. I noticed virtually no trim changes. Just after passing the end of the runway I started the curved approach and called for full flap. We came "round the corner" at 170 kt, with 6,000 r.p.m. giving us a comfortable (jet) rate of descent of 2,000ft/min. It was very much like the Meteor's approach, except that there was no control-sensation of decreasing speed. From a few hundred yards out I aimed a glancing blow at the runway, reducing speed and counteracting the cross-wind. The Hunter touched down perfectly comfortably, though I made it a little too fast. I raised the nose to get aerodynamic braking, but to little effect, and finally I put the nosewheel down and braked fairly firmly to stay within the allotted 2,000 yd of concrete. A much more normal landing run is 1,400 yd.

I should have landed rather more slowly, but the brakes coped with the excess speed without any signs of torture. The Hunter, once down, derives a great deal less drag from frontal area and wheels than does the Meteor, but the brakes are very powerful and respond far more quickly and firmly. Taxying back to dispersal, I found the Hunter exactly like the Meteor to manage, but much more sensitive on the brakes.

In summing-up the Hunter Two Seater one might well quote the American who described a new aircraft as being "a bird in which the pilot can really get with it." The tremendous urge, effortless climb and remarkably even handling characteristics, coupled with so moderate a landing performance, will imediately appeal to pupils, just as they are already satisfying the Hunter 6 fighter pilots.

New Horizons

INTO the back of beyond, over jungle, among cloud-swathed mountains, into precipitously perched grass clearings and out again, fly the Scottish Aviation Twin Pioneer demonstrators. Day by day the possibilities of these sturdy, roomy STOLs from Prestwick are brought more and more to the notice of operators and local authorities. Pilots appreciate the Alvis Leonides engines—dependable, light for their power, and two in number; and they enthuse about handling. "The stall is rather a joke", wrote the Editor in one of his "In the Air" series ("Flight," November 25, 1955). "With take-off flap and no power, the Pioneer gets slower and slower and slower. Finally, with wheel on the back stop, it gives a slight shrug as if to say 'Since you insist', and then gently bows in submission, with wings level, and continues in its glide with the nose a few degrees lower."

From recent tours and demonstrations come these pictures. Above, an idyllic scene at Long Atir, Sarawak. Left, the Shah of Persia at Teheran. Below, almost among the clouds at Santa Rita, Colombia.

DREIDECKER

German and Austrian Triplane Fighters of the 1914-18 War

"PERHAPS the greatest compliment the enemy paid the Triplane was the appearance, in rapid profusion, of an astonishing number of German and Austrian triplane single-seat fighters, soon after the Sopwith machine proved its mettle. Triplanes were not altogether new in Germany: an Euler triplane (and doubtless others) had flown before the war, and the German aircraft industry had a number of designers who favoured triplanes. It seems, however, that that favour stemmed from structural considerations rather than from operational requirements." [From J. M. Bruce's story of the Sopwith Triplane in "Flight" for April 19 and April 26, 1957.]

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1 *The A.E.G. triplane was a modification of the A.E.G. D.I biplane, powered by the 160 h.p. Mercédès engine. The wings were of unequal chord, and only the top and bottom mainplanes had ailerons.*

2 *The A.E.G. PE I was an armoured triplane which provided the basis for a later biplane trench-strafer, the A.E.G. D.J.I., The engine was the 195 h.p. Benz.*

3 *The Albatros L.36 was a triplane version of the D.Va. Like the biplane, it had the 160 h.p. Mercédès engine.*

4 *The second Albatros triplane was the L.39, here seen with the improbable marking DR.II. It was a development of the biplane Albatros D.X. The engine was the 195 h.p. Benz Bz.IIIb, and the two radiator blocks were perched above the centre mainplane.*

5 *The Oesterreichische-Aviatik (Berg) triplane of May, 1917, consisted of the fuselage and tail unit of an Ö-Aviatik D.I fitted with triplane wings of 6.86m span. Power was provided by a 200 h.p. Daimler, and the maximum speed was 195 km/hr.*

6 *The Brandenburg L.16 is here seen in the form in which it was flown in Austria, with the 185 h.p. Austro-Daimler and the radiator immediately above and behind the engine. In its original form, its radiator was in two parts, one on each rear centre-section strut.*

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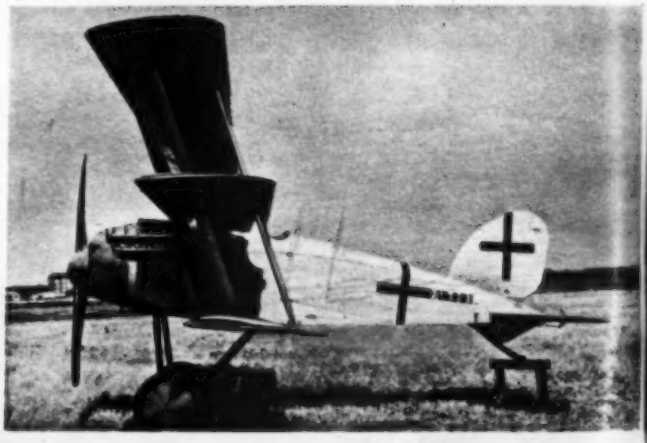

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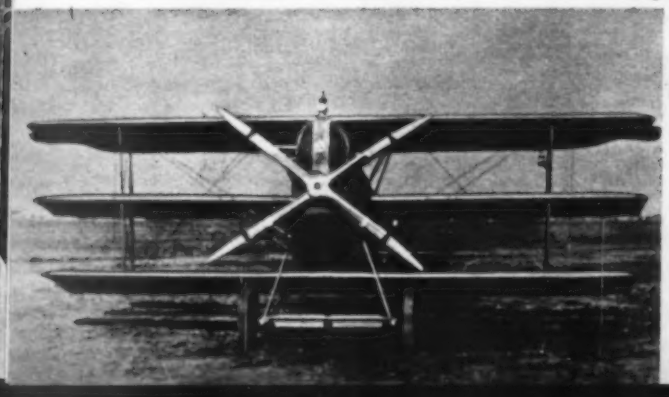

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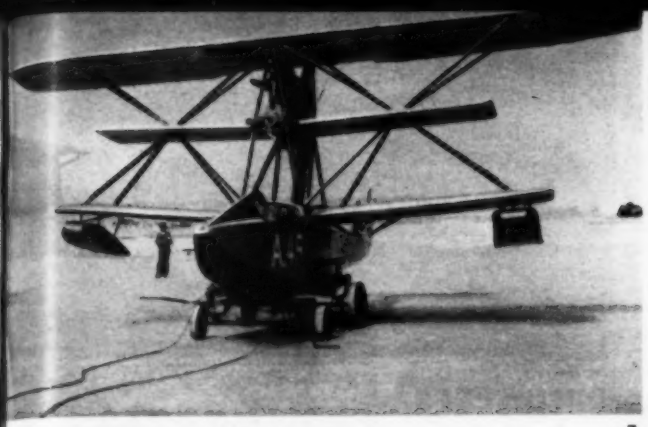

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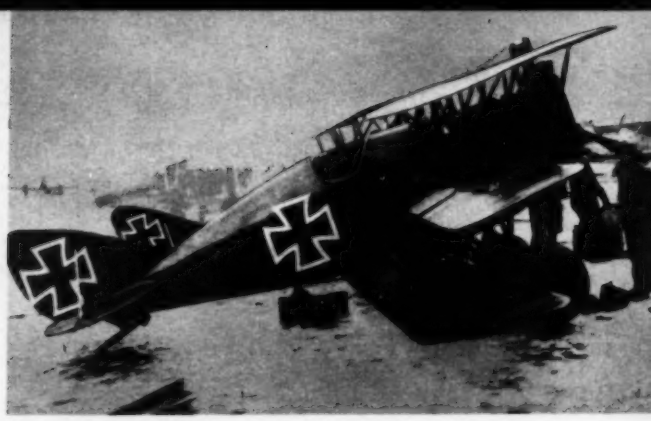

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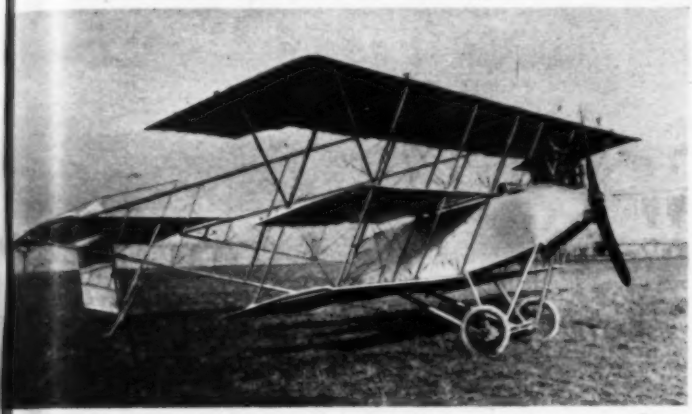

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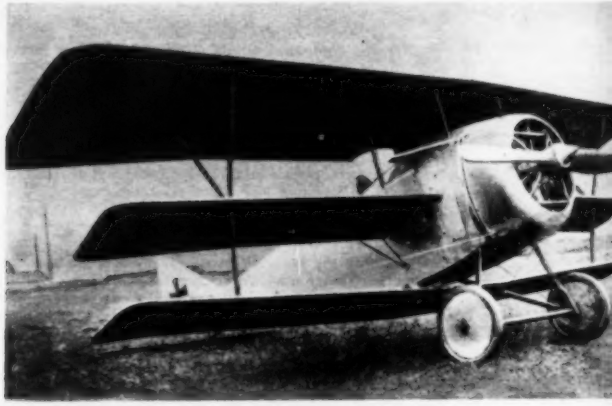

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THIS unique collection—more will be found overleaf—illustrating German and Austrian triplane single-seat fighters of the 1914-18 war, includes some extreme rarities and is a fitting sequel to Mr. Bruce's recent contribution on the Sopwith Triplane. The photographs of the Albatros L.39, Euler 1911 triplane and Sablatnig SF.4 were provided by Mr. A. R. Weyl, A.F.R.Ae.S., A.F.I.A., F.B.I.S.; all the others are from the collection of Mr. Peter M. Bowers.

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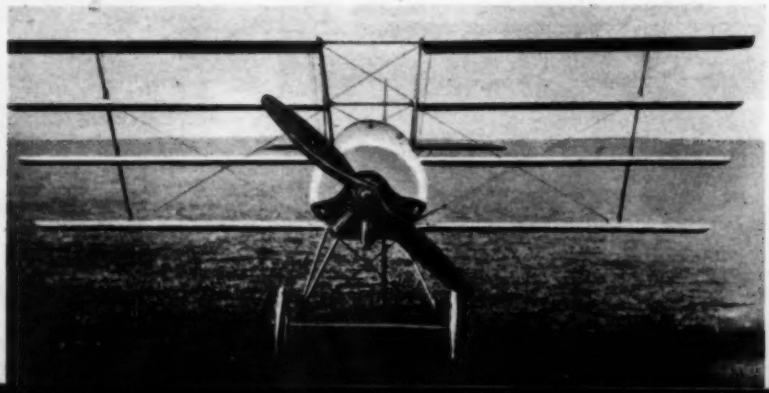

7 *The Brandenburg CC single-seat fighter flying boat was produced in some numbers for the Austro-Hungarian navy, to whom it was known as the Brandenburg KDW. This machine, A.45, was a triplane version of the KDW; like the standard KDW, it had the 185 h.p. Austro-Daimler, but the radiator was in the starboard top wing instead of in front of the engine.*

8 *The D.F.W. triplane was one of the least-known German single-seat triplanes. It had two-bay bracing, and only the middle wing was fitted with ailerons.*

9 *One of the earliest German triplanes was this remarkable Euler design of 1911.*

10 *Six years later this clumsy Euler single-seat triplane was built. The power unit appears to have been an Oberursel rotary engine.*

11 *The second war-time Euler triplane was a much cleaner aircraft of pleasing appearance, also powered by an Oberursel rotary.*

12, 13 *The so-called Euler quadruplane was basically a triplane. The top surfaces were merely ailerons of great area; each moved as a whole, presumably to ensure maximum manœuvrability. The three wings proper were conventionally braced as a triplane structure.*

14

14 *Possibly the cleanest German triplane of the war was the final Euler design. It had two-bay bracing, but looked somewhat frail.*

15 *The Fokker V.4 was the prototype of the Fok. Dr.I, and was designed by Reinhold Platz. It had fully cantilever wings, plain ailerons and plain elevators.*

16 *Fok. Dr.Is on the Western Front. The power units of many production machines were Swedish-built 110 h.p. Le Rhônes, which were greatly superior to contemporary German rotaries. Note the interplane struts, horn-balanced ailerons and horn-balanced elevators.*

17 *The second Fokker triplane, also designed by Platz, was the V.6. It was slightly larger than its predecessor and had a 120 h.p. Mercédès engine.*

18 *The Fokker V.8 was unquestionably the most peculiar aeroplane built during the 1914-18 war. Its construction was insisted upon by Fokker against the advice and wishes of Reinhold Platz. It was flown only twice and—it seems almost superfluous to add—was not a success.*

19, 20 *The Lohner triplane had unusual interplane bracing. It was a triplane version of the Lohner biplane fighter 113.03. The engine was the 185 h.p. Austro-Daimler, span 8.8m, and speed 178 km/hr.*

21 *This Naglo type is usually regarded as a quadruplane, but the three major mainplanes were braced as a triplane structure. The fourth wing was a semi-cantilever surface mounted below the fuselage.*

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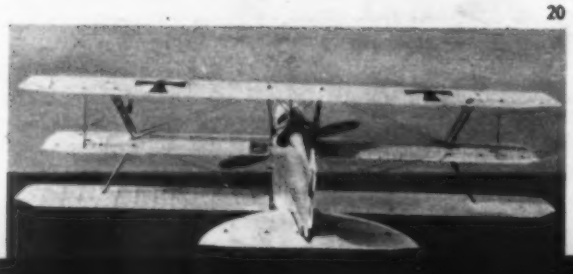

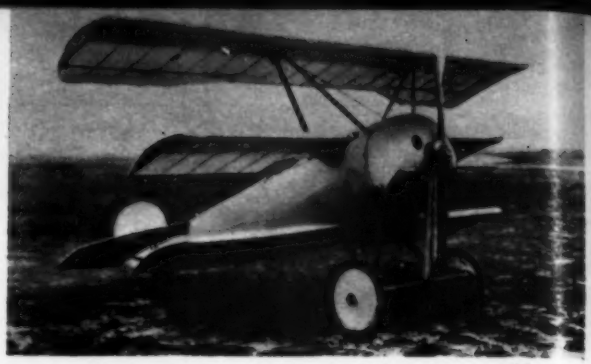

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DREIDECKER . . .

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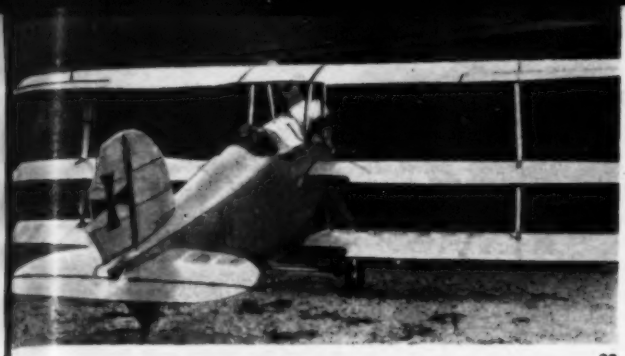

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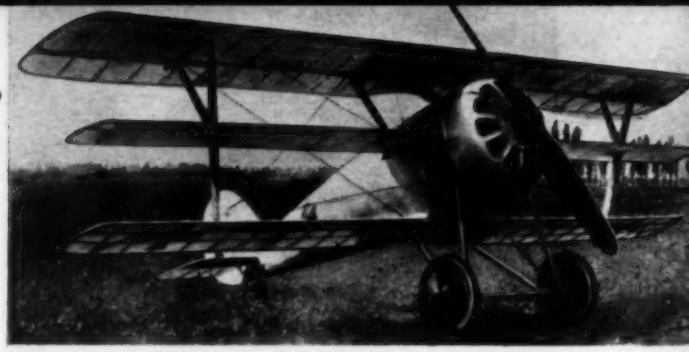

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22 *Another Austrian design was the Oeffag triplane, 50.14, built by the Oesterreichische Flugzeugfabrik A.G. of Wiener Neustadt. It had a 200 h.p. Austro-Daimler engine.*

23 *The Pfalz Dr.I went into small-scale production, and a few were flown operationally. The engine was a 160 h.p. Siemens-Halske rotary. Span was 8.55m, and the middle wing was of remarkably narrow chord.*

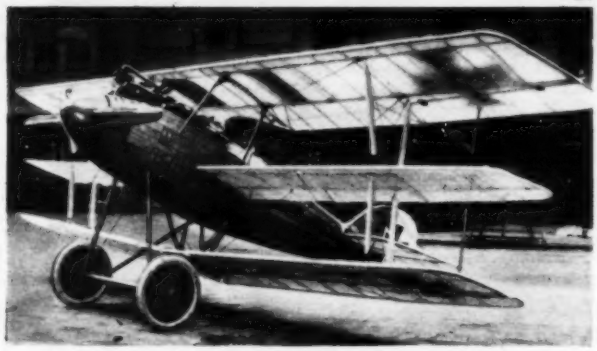
24 *Most of the Roland aircraft of the war period had clean lines, and the Roland D.IV triplane was no exception. The engine was the 160 h.p. Mercédès and, as on the A.E.G. triplanes, ailerons were fitted to the top and bottom wings only.*

25 *Two Sablatnig SF-4s were built, both single-seat fighter seaplanes. The first, No. 900, was a biplane; and No. 901, illustrated here, was a triplane. Span was 9.25m.*

26 *In the Schütte-Lanz triplane, only the two lower wings were staggered, and only the two upper wings had ailerons. The power unit was a 160 h.p. Mercédès.*

27 *The Siemens-Schuckert-Werke DDr.I was the only single-seat triplane to have twin engines; a 100 h.p. Siemens-Halske Sh.I bi-rotary engine was mounted at the nose of the short nacelle and a second at the rear. It was wrecked on its first flight.*

28 *The W.K.F. triplane, 80.05, was a well-proportioned Austrian design powered by a 200 h.p. Austro-Daimler engine. The span was 8m.*



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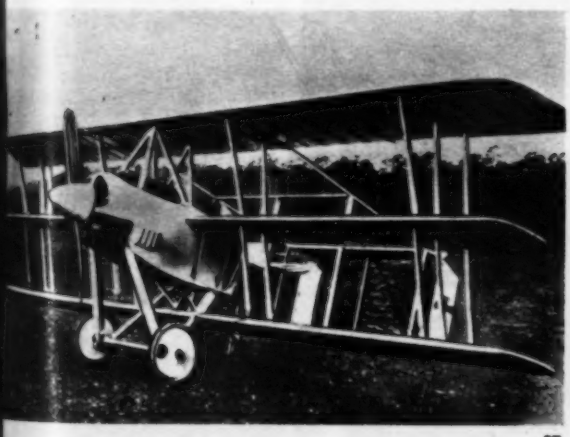

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Left to right, Messrs. Forrest and Gunn, awarded the George Taylor Gold Medal, and Mr. E. G. Broadbent, who received the Simms Medal.

R.Ae.S. AWARDS

—*for the Year's Best Papers*

AT the annual general meeting of the Royal Aeronautical Society, held on May 8, prizes were awarded for papers read during the past year. The presentations, made by the retiring president, Mr. E. T. Jones, were as follows:—

George Taylor (Australia) Gold Medal (for the most valuable contribution on aircraft design, manufacture or operation read before, or received by, the Society): Mr. G. Forrest and Mr. K. Gunn, for their paper *Problems Associated with the Production and Use of Wrought Aluminium Alloys.*

Simms Medal (most valuable contribution on any subject allied to aeronautics): Mr. E. G. Broadbent, for his paper *Aeroelastic Problems in Connection with High Speed Flight.*

Edward Busk Memorial Prize (most valuable contribution on applied aerodynamics appearing in one of the Society's publications): Mr. I. M. Davidson, for his paper *The Jet Flap.*

Orville Wright Prize (most valuable contribution to *The Aeronautical Quarterly* on some subject of a technical nature in connection with aeronautics): Dr. B. S. Stratford, for his papers on the jet flap.

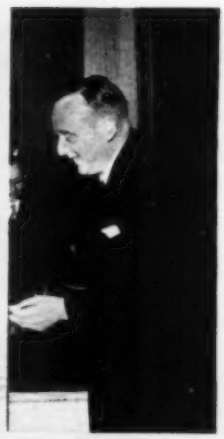
Herbert Akroyd Stuart Memorial Prize (most valuable contribution to the Society's publications on applied thermodynamics): Dr. J. S. Clarke, for his paper *A Review of Some Combustion Problems Associated with the Aero Gas Turbine.*

Branch Prize (best paper on an aeronautical subject read before the branches and appearing in the Society's publications): Mr. E. R. Major, for his paper *Some Maintenance Aspects of Viscount Operation.*

Navigation Prize (best paper on navigation, including meteorological instruments and test equipment, published by the Society): Mr. R. A. Burberry, for his paper *Aerial Systems for Aircraft.*

Usborne Memorial Prize (best contribution to the Society's publications written by a Graduate or Student on some subject of a technical nature in connection with aeronautics): Mr. T. M. Corson, for his paper *The Propeller-Turbine in Airline Service.*

Left, Mr. E. T. Jones, the retiring president, hands over the insignia of office to his successor, Sir George Edwards.



Above, left to right, Mr. Jones presents the Edward Busk Prize to Mr. I. M. Davidson; Dr. B. S. Stratford steps up for the Orville Wright Prize; and Dr. J. S. Clarke receives the Stuart Memorial Prize. Recognizable in the backgrounds are Sir Arnold Hall and Sir Sydney Camm.

Right (l. to r.), Mr. E. R. Major (Branch Prize), Mr. R. A. Burberry (Navigation Prize), Mr. T. M. Corson (Usborne Prize).

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Express Post—by Britannia

I AM sure you will be interested to know that our copy of the April 26 issue of *Flight* was awaiting collection in our Post Office box at 0815 hours on Tuesday, April 30. This is a record—normally it arrives on Thursday mornings.

Let's hope it finds its way into a Britannia mailbag every week!

Wellington, N.Z. G. CARTER, A. CDRE.
Managing Director, Bristol Aeroplane Co. (New Zealand), Ltd.

Flight Plans and Air Traffic Control

MAY I, an ex-R.F.C. pilot who for the past fourteen years has been an air traffic control officer, not connected with the M.T.C.A., say how sorry I am to read that Major Draper, D.S.C., [Correspondence, May 3] found it humiliating to be subjected to air traffic control regulations during his recent flight from Croydon to Cardiff, especially as he seems to have got lost, not in the air but amongst the I.C.A.O. four-letter abbreviations for airports?

Except for the particulars given in *Flight*, I have no knowledge either of the controllers concerned (unless they be fellow-members of my Guild) or of the weather and other factors at the time of the flight; but Maj. Draper's knowledge of the atmosphere he mentions must tell him how quickly weather conditions change in this country, and he must know that watch-keeping air traffic control officers do not compile the regulations, but that it is their duty to comply with them and to see that aircrew do so as well.

He must know, also, that in these days of high-density air traffic some system of control is necessary; and that, could a comparable air traffic control system have existed forty years ago, more of his (and of my) friends would be alive still.

Melton Constable, Norfolk. J. F. HIGGINS.

Airline Airships Again?

I WONDER whether Mr. Cleaver, in his study on aeronautical prophecy (*Flight*, March 22 and 29), may not have been a little premature in writing off the airship as a long-range transport vehicle? After all, it is only with the advent of the DC-7C and Britannia that it has once again become possible to fly a regular passenger service in a single stage from European capitals to New York as was done by the Zeppelin *Hindenburg* 20 years ago.

It is true, of course, that the aeroplane is much faster than the airship; but is speed the sole criterion by which transport vehicles are to be judged? If so, is it not surprising that ocean liners are still being built?

Airships are basically safe because they can take off and land slowly, have an almost unlimited endurance and are not placed in jeopardy by the failure of engines. How many aeroplanes have been lost through lack of these qualities? A study of accident statistics is not calculated to comfort would-be air travellers. By contrast, in the history of commercial airship operations, which began before the First World War, fewer than fifty fare-paying passengers have lost their lives. This bears thinking about. Moreover, airships provide much of the roominess and comfort of liners, whereas aeroplane accommodation approximates increasingly to the sardine tin. Last but not least, there are grounds for thinking that airship passengers could be offered not only safer and more comfortable, but also cheaper, travel.

With the help of a little "guestimation" let us bring the Burney project up-to-date (retaining, however, the traditional shape and operating technique). Assuming a gas capacity of 11,000,000 cu ft to give a lift of about 300 tons, using helium, this ship would be 900ft long and 150ft in beam. She would have a metal skin, in place of the traditional fabric cover, as in the experimental American Metalclad, *circa* 1930.

Guestimate 1.—Taking a pessimistic view, it ought at least to be possible to achieve a total structure weight, including engines, passenger accommodation and equipment, of not more than half of the total lift, leaving 150 tons of dispersable load.

Guestimate 2.—The ship would require about 7,500 h.p. to push her along at a cruising speed of 90 kt (three Nomads, perhaps, with a specific fuel consumption of ½ lb/bhp/hr). On this basis fuel and oil for 5,000 n.m., i.e., London - New York with two-thirds reserve, would amount to about 65 tons.

The water content of the exhaust gases is recoverable for ballast and domestic use, and only five tons would be carried initially. The crew of 100 would account for about ten tons. Food, drink and miscellaneous, ten tons.

This leaves 60 tons for passengers and freight, say 240 passengers with a luggage allowance of 120 lb each, and 30 tons of freight.

The ship should be able to make her passage from London to New York in the course of two nights and the intervening day, so that a businessman would lose only one day's work.

Provided that care was exercised in conserving the expensive helium the ship should prove a commercial proposition, but, of course, where airships are concerned, the bigger the better. A 1,000-tonner, for example, could carry 1,000 passengers and 125 tons of freight across the Atlantic at 100 kt. Do not be put off by her length of 1,350ft. Size is a purely relative concept and has little relevance to the problem. There is plenty of sky to float her in. She would be built in a sheltered valley and would live in the open for the whole of her life, so no hangar would be required.

It may be of interest to shipping companies that such an airship would consume little more than three tons of fuel per hour. Surface ships can never be efficient when used only for passenger transport, because the load carrying capacity cannot be properly utilized and too many tons have to be pushed through the ocean for every passenger embarked.

And if we are going to take atomic propulsion for aircraft seriously why not try it in a large airship first? At least it could be guaranteed to lift the plant off the deck.

Nicosia, Cyprus. F. P. U. CROKER,
Lieut-Cdr., R.N. (Retd).

J. M. Bruce's Magnum Opus

UNDOUBTEDLY one of the most exciting features appearing in *Flight* of recent years has been the series on famous World War I British aircraft. After the recent story of the Sopwith Triplane there would appear to be very few major types left with which to deal. At this stage, then, one looks forward inevitably to an announcement of a book combining the complete series and also any lesser but none the less interesting types not previously covered in the comprehensive type histories.

Not the least important has been the spate of correspondence and photographs adding to, or even in some cases correcting, the original articles of Mr. J. M. Bruce. It is to be hoped that the additional evidence thus made available will be taken into account and incorporated in the final volume. The extra time and care will be amply repaid if a production can be achieved which does not suffer even the minor faults and blemishes which marred the inspiring pages of the original *Aircraft of the 1914-18 War*.

It seems strange that nearly 40 years have elapsed since the book to end all reference books on 1914-18 aircraft has been tackled. It is essential, however, to place on permanent record the enthralling story of those gallant days of the birth of aviation when flying was flying and aircraft were not piloted missiles jet-propelled by brute engine force and aerodynamic guesswork.

Southampton. J.O.I.

[J. M. Bruce's *British Aeroplanes, 1914-18*, is to be published in the autumn by Putnam. They have recently announced that the book, which is to consist of some 700 large pages, will contain the fullest possible descriptions of 286 basic types, with details of all known variants. "All operational types," they state, "receive the same generous treatment as those described in the author's series of articles in *Flight*, but the specifications of the aircraft are more detailed than any hitherto published."—Ed.]

FORTHCOMING EVENTS

May.	17.	Institute of Navigation: "Navigation and the Airlines," by E. W. Pike.
May	18.	British Interplanetary Society: A.G.M. and Brains Trust.
May	18-20.	Quiberon Aero Club: Air Rally and International Touring Meeting, Quiberon.
May	21-23.	European Aircraft Ignition Conference (Champion Sparking Plug Co.), London.
May	24-June 2.	Paris Aero Show, Le Bourget.
May	25.	Elstree Flying Club: At Home and Flying Display.
May	25-26.	Popular Flying Association: Annual General Meeting.
May	26.	Luton Flying Club: At Home and Flying Display.
May	28.	R.Ae.S.: Section Lecture: "Flight Instruments," by F. W. Meredith, F.R.Ae.S.
May.	31-June 1.	Aero Club of South Africa: Governor-General's Air Race.
June	1-2.	Aero Club of Western France: International Rally, Anjou.
June	5-7.	Institute of Navigation: "Avoidance of Collision by Shipborne and Airborne Means," a Three-day Conference in conjunction with the French and German Institutes.
June	8-10.	Fréjus-St. Raphael Aero Club: 4th International Rally, Fréjus.
June	9-10.	Austrian Aero Club: International Rally, Vienna/Aspern.
June	9-10.	British National Model Aircraft Championships, R.A.F. Waterbeach.
Sept.	2-8.	S.B.A.C. Show, Farnborough.

THE INDUSTRY

New Plessey Company

FORMATION by the Plessey Co., Ltd., and the American Philco Corporation of a new company—to be known as Semiconductors, Ltd.—to manufacture transistors and other semiconductors in this country was announced on May 2. Its joint Board has Mr. A. G. Clark as chairman and Messrs. J. M. Skinner, Jnr., J. F. Mallabar, L. J. Woods, A. E. Underwood and P. Marriage as directors.

Airscrew Company's Chairman

IT is announced that Mr. Eoin C. Mekie, C.B.E., has been elected chairman of the Airscrew Co. and Jicwood, Ltd., and Mr. F. C. Lynam, F.R.Ae.S., director and general manager, has been appointed managing director. Mr. Mekie is chairman of the British Aviation Services group of companies.

Discussions were recently reported to be taking place between the Airscrew Co. and Bryant and May, the match manufacturers, with a view to possible financial collaboration.

Woodason Models Again

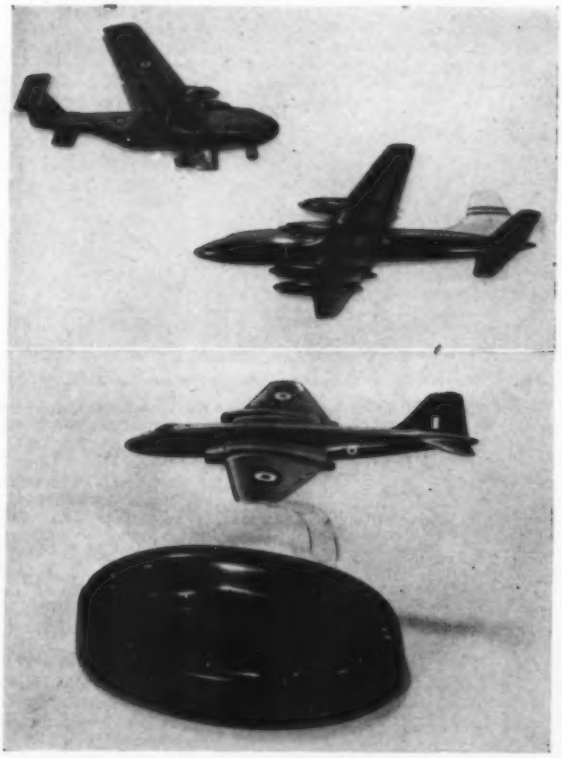
AFTER a long illness, Mr. V. J. G. Woodason, of 604 London Road, Slough, Bucks, has begun to make aircraft scale models once again. Until a few years ago his products were greatly in demand in the industry for development and display purposes.

Mr. Woodason is now engaged in making a new type of plastic model which should be well suited for use on display stands and in shop windows where space is limited. Each model is in the form of a *bas relief* giving a perspective view of the aircraft. A realistic effect is achieved, though the thickness is only an inch or so.

For production purposes, a photograph can serve as a basis from which the mould is made, and thereafter an unlimited number of models can be moulded and painted. Mr. Woodason has also devised a method of mounting the *bas relief* within a miniature replica of an airliner window with a realistic background, so that the model appears to be viewed from another aircraft in flight.

Examples of types so far produced include the Beverley, Britannia, Viscount, Canberra and Gnat.

Typical plastic models by V. J. G. Woodason (see above).



A team of Rolls-Royce engineers recently visited the Queen's Island works of Short Brothers and Harland, to discuss engine installation in the SC.1 (this VTOL aircraft has five R.B. 108s). Seen here are, left to right, Mr. E. C. Fox (systems engineer, Shorts), Mr. J. Bromilow (Rolls-Royce), Dr. C. T. Hewson (Rolls-Royce), Mr. W. Brunskill (project engineer, Shorts) and Mr. F. Raper (Rolls-Royce).

IN BRIEF

Mr. L. M. Broadway has been elected deputy chairman to the Board of C. C. Wakefield and Co., Ltd., and will hold this office in conjunction with his position as managing director.

* * *

After a long association with Thermionic Products, Ltd., of Hythe, Mr. V. J. Falconer has resigned in order to join Electrovoice, Ltd., of 39 Dover Street, London, W.1.

* * *

A new edition of the leaflet in which all components of the Hellermann binding system are described and illustrated is now available from Hellermann, Ltd., Crawley, Sussex.

* * *

Marshal of the R.A.F. Lord Tedder is to open the new metallurgical laboratories of the British Welding Research Association at Abington Hall, Abington, near Cambridge, on July 23.

* * *

The electronics division of Gresham Transformers, Ltd., which manufactures transformers up to 2,000 VA for electronic and telecommunication purposes, is now established at Lion Works, Hanworth Trading Estate, Feltham, Middlesex (Feltham 6661).

* * *

Pye Telecommunications, Ltd., have appointed S.M.D. Telecommunications (Pty.), Ltd., P.O. Box 10013, Johannesburg, as sole distributors of Pye radio-communication equipment in the Union of South Africa, the Protectorates of Bechuanaland, Swaziland and Basutoland, and Mozambique south of the Save River.

* * *

We regret to record the death, at the age of 66, of Mr. W. Ivan Walters, founder, chairman and managing director of the Walterisation Co., Ltd., of Croydon. Inventor (with his brother, Mr. E. Alun Walters) of an improved phosphating process, he established the present company in 1936. Approval of the Walterisation process by the Air Ministry in 1939 led to its extensive use by the aircraft industry during the war.

* * *

Mr. E. E. Chatterton, chief engineer of the piston-engine division of D. Napier and Son, Ltd., is to receive an award from the oil and gas power division of the American Society of Mechanical Engineers for the paper, *The Future Development of the High-speed Diesel Engine*, which he read at the 1956 A.S.M.E. annual meeting in New York. The award is to be presented next Wednesday at the A.S.M.E. division's annual conference in Louisville.

* * *

Black and Decker, Ltd., Harmondsworth, Middlesex, announce the appointment of Mr. J. P. Jamieson as sales manager for their industrial and automotive range of portable electric tools. He takes over the post recently relinquished by Mr. F. A. Field who, after 19 years with the company, has been appointed managing director of Eutectic Welding Alloys, Ltd. Another Black and Decker appointment recently notified is that of Mr. Drummond R. Stuart as general manager of the Toronto, Canada, subsidiary.

* * *

Two old-established building and civil engineering businesses, John Laing and Son (Holdings), Ltd., and Holloway Brothers (London), Ltd., have jointly announced "that agreement has been reached in principle to the acquisition by Laings of a substantial interest in the Holloway company and to its future operation in association with the Laing group." Holloways will continue to operate under the management of the Holloway family and the agreement will enable the company to take advantage of the research, plant and other facilities of the Laing group.

DEBATING THE AIR ESTIMATES

Britain's New Radar: Transport and Trooping

IN the House of Commons, on May 9, the debate opened on the Air Estimates for 1957-58. The Secretary of State for Air, MR. GEORGE WARD, explained that although the money which Parliament was being asked to vote for the R.A.F. (£49,070,000) was £10 million more than last year, the true expenditure covered by the Estimates would be less by about £19 million.

Our force of Valiants, he continued, was complete. The Vulcan O.C.U. was operating and squadrons would soon form, while the Victor O.C.U. would form later this summer. V-bombers would continue to play their part after the ballistic missile had entered the Service. By the end of the year almost all our day-fighter squadrons would have been equipped with Hunter 6s; the proportion of Javelin squadrons was building up in the all-weather force; and development of the P.1 was going well. The Fireflash missile had started Service trials on the Swift 7 and acceptance trials of Firestreak would start later in the year. The Firestreak should greatly increase the killing power of Javelins and P.1s.

Technical progress in the last five years had revolutionized and simplified the problem of control and reporting. The heart of our latest radar defence chain was a high-powered radar acting both for early warning and control. The commander of the defensive forces could now have before him an instantaneous picture of threatened attack some hundreds of miles beyond our coasts. The number of radar stations we needed was smaller, and new plans would result not only in a reduction in the number of sites but in manpower; and, added Mr. Ward, "we have not nearly finished."

For long-range transport the Britannia 253 would take the main load; 13 were on order and more would follow. The first should come into the R.A.F. next year. For the present we must rely on Comets 2s and Hastings; eight Comets were already in Transport Command and the other two would be delivered very shortly. The Comet squadron was about the same size as B.O.A.C.'s former Comet 1 fleet. The reliable Hastings would carry 44 troops over a stage-length of 1,500 miles and had a very useful freight capacity. As the Britannia entered service the Hastings would become a medium-range transport, in which rôle we could plan to have several squadrons for some years. The Comet, with a slightly greater range than the Hastings, would remain in the long-range force. For movement within overseas theatres we should rely largely on Beverleys, supplemented by Hastings. The Beverley, a large number of which were on order, could carry more than 90 troops over medium distances. We also needed a number of smaller aircraft for movement within tactical areas—for example some twin-rotor helicopters; and the Twin Pioneer would supplement the Pioneer. In terms of passengers carried at any one time there had already been a two-fold increase within Transport Command during the past twelve months. It was hoped that in about three years' time the effective air transport capacity available to the Service would be nearly three times what it was today.

The Minister went on to a statement on air trooping, pointing out that to ensure flexibility and economy Government policy had been to invite independent operators to carry out the task, and carriage of military personnel represented about 65 per cent of their passenger activities. Before a contract was let, method of operation, routes, crew qualifications, navigational facilities and loads were examined and approved by the M.T.C.A. The standards were those applied to B.E.A. and B.O.A.C., and were above those required by statute. Since 1951 independent operators had carried well over 600,000 passengers, and during that period there had been five accidents involving loss of life. Since the same date, on the routine movement of passengers on scheduled services between theatres, Transport Command had carried about 100,000 passengers in addition to making many *ad hoc* trooping flights. From all those flights the only fatal accidents were one at Lyneham in 1954, when one member of a Valetta crew was killed, and the accident to the Beverley at Abingdon this year.

It had often been argued, said Mr. Ward, that safety would be improved if more modern types of aircraft were in use, but he did not believe that this was true. The suggestion had been made that there should be an inquiry by an independent committee—drawn from outside the R.A.F., the Civil Service and the aviation industry—into present policy on military air transport and air trooping. He had discussed the matter with the Minister of Transport and Civil Aviation, but the Government, having carefully examined this proposal, must reject it. They accepted full responsibility for their policy in all matters and were answerable not to any *ad hoc* committees of inquiry, but to Parliament.

The Government completely rejected the suggestion that their trooping policy was directly or indirectly endangering life unnecessarily. People should think more seriously before making such serious charges, which cast the gravest reflections upon the competence and responsibility of British air transport companies and upon the safety and reliability of British aircraft. They rejected completely all such imputations. He [Mr. Ward] had already given some explanation of the air safety standards which were required in the operation of trooping flights by the independent companies. Moreover, examination of the findings of air accident investigations entirely vindicated the confidence which the Government had in the safety standards which were required for air trooping, in the efficiency with which air transport operators, whether the Corporations or the independents, implemented these requirements, and in the aircraft themselves.

In the safety record of Transport Command, continued the Minister, there had been no deterioration over the last six years; indeed, there was some improvement. The records of the independent airlines and the Corporations were both most satisfactory. Naturally, the Government very much wanted to bring modern aircraft, such as the Viscount and the Britannia, into the trooping field, not because there is any question of the safety of the older types, but because they wanted to take advantage of the greater economy, speed and other operational advantages, including passenger comfort, of the more modern ones. For this reason, they would like to let contracts for longer periods than they had so far been able to do, because civil operators could only finance the re-equipment of their companies with modern types if they were given a guarantee of their use over a reasonable period. But the difficulty was to forecast long-term trooping requirements on a sufficiently firm basis.

The future of the three Britannias being built to the order of the M.o.S. was now being examined, added Mr. Ward. These were for trooping, particularly to the Far East. Tenders from independent operators would be invited in the very near future.

The Minister then turned to manpower, recalling that the Minister of Defence had estimated that the three Services might have a surplus of between 5,000 and 7,000 officers and a similar number of warrant officers and N.C.O.s. The R.A.F.'s share would be considerably less than one-third of the total. To those who would have to leave the Service prematurely it was intended to give fair compensation. The improvement in regular recruiting had been maintained, but not enough women were being recruited to retain the W.R.A.F. at its present strength.

POINTS FROM THE DEBATE

MR. GEOFFREY DE FREITAS (Lab., Lincoln) was distressed to read that the coming of guided weapons had been greeted by an Air Ministry statement that there was no reason to expect startling changes in the R.A.F.'s career or trade structure. How, he asked, could the structure of a Service which was designed for manned aircraft not be drastically changed to meet the training, maintenance and operational needs of guided weapons?

MR. P. B. LUCAS (Con., Brentford and Chiswick) agreed that the publicity and advertising which would have to be undertaken by the Service would be most important. It was something which should be treated almost on a commercial basis. He was bound to say that the publicity arrangements of the Air Force had recently shown a great improvement.

MR. GEORGE WIGG (Lab., Dudley) made reference to a Handley Page Conway-Victor, an improved Avro Vulcan, the Avro 730 supersonic bomber and the Avro 731 scale model. He quoted detailed figures for aircraft orders, which he said had been compiled by the quality of diligence.

A.CDRE. A. V. HARVEY (Con., Macclesfield) said that the P.1 was only "partly supersonic." He would say that the Americans had nothing like our V-bombers, or as good; nor, as far as he knew, had the Russians. These bombers were absolutely supreme in altitude, range and speed.

GOVERNMENTAL INSPECTION

Mr. C. I. Ort-Ewing, O.B.E., M.P., Under-Secretary of State for Air (wearing hat), and Mr. Julian Amery, M.P., Under-Secretary of State for War, arrived at R.A.F. Station Valley, Anglesey, in a de Havilland Devon of Transport Command on May 7 to inspect guided-weapon establishments in the vicinity. (Valley itself is understood to house a unit of Swift F.7s engaged in development and indoctrination trials with Fireflash, and the island will also have surface-launched-missile sites.)

CLUB AND GLIDING NEWS

The Czechoslovak L.13 "Blanik" high-performance two-seater sailplane — familiarly known as the "Cadillac" to western observers at the St. Yan contests last year.

CONGRATULATIONS to the Armstrong Siddeley Flying Club "for finding an original excuse for a party" were voiced by Mr. Basil Meads of the Kemsley Flying Trust at the club's dinner and dance last Saturday, May 11. The excuse was the final repayment of the K.F.T. loan which had assisted in the purchase of the club's Tipsy Trainer G-AFSC. Mr. Meads recalled that the A.S. club had been the first of the private-ownership groups to obtain such a loan and, not only was the club the first in—it was also the first out.

Other speakers at the dinner included Edward Felce, first chairman of the club, who reviewed its history; Ron Christmas, the present chairman; and Maurice Imray, secretary of the Popular Flying Association, who presented a new cup for the club's most outstanding pupil of the year to Frank Hudson, for his rapid progress towards his P.P.L. After the dinner, which was held in the Coventry Aeroplane Club's club-house at Baginton, members and guests thoroughly enjoyed the evening's dancing, in which the agility of the younger members was matched by the distinguished rocking and rolling of the energetic Basil Meads.

ELSTREE'S At Home and air display on Saturday, May 25, is planned to include a club formation flight, parachute jump, sailplane display, instructors' race and demonstrations by members of the Tiger Club. Aircraft types to be put through their paces include the E.P.9, Chipmunk and Comper Swift.

Pleasure flights will be available. Admission for members of the general public will be by programme, price 1s at the gate; visitors by air are asked to arrive before 2.30 p.m. The programme should end at about 5 p.m.

THE Armstrong Whitworth Flying Group recently completed a successful first year's operations. Flying Tiger Moth G-ALWW, the group's 60 members logged a total of 270 hours. W. Johnson gained his P.P.L., and first solos were logged by F. Wheeler, O. Shorthouse, J. Rose, T. Elliott, M. Hunt and A. Thomson. The group's flying rate, determined on a non-profit basis, is 36s per hour. Membership of the group, which for social purposes is affiliated to the Coventry Aeroplane Club, is confined to employees of Sir W. G. Armstrong Whitworth Aircraft, Ltd., and since its conception in September 1955 there has been a waiting list to join. The group is fortunate to have the voluntary services of three instructors, the C.F.I. being N. Slater, assisted by B. Woolston and (when his duties with Coventry Aeroplane Club permit) B. Lavell. The year's excellent serviceability record on the Tiger stands to the credit of N. Roper, the ground engineer.

LAST month's landmark competition of the Scottish Aero Club, Perth, was won by T. Nicoll and D. Young, with D. McLennan and D. Rhind as runners-up. Private Pilots' Licences have been obtained by three of the A.T.C./C.C.F. cadets at Perth.

ORKNEY Flying Club is being disbanded, and its Tiger Moth has been sold to the Edinburgh Flying Club. The Orkney secretary said recently that the island's population was too small to support the club.

FROM the industrial West Riding comes news of the first flight of the Halifax Gliding Club. On April 28 the first four launches were made in a Kerby Kite sailplane from the private airfield at Crosland Heath, near Huddersfield, which is owned by Mr. David Brown of Meltham. Shortly after its formation in January 1956, the club purchased a Slingsby Tutor from a private owner for £60. Since then members have been hard at work stripping and re-covering the machine at the club's workshop in Halifax—an operation adding an extra £40 to the original cost. It is to undergo an inspection for a new Certificate of Airworthiness this month. The Kite, at one time the property of the Midland Gliding Club, is privately owned by a member who has placed it at the disposal of the club for a time.

APRIL'S good gliding weather resulted in a total of 540 hours being logged at the Lasham Gliding Centre. Launches numbered 2,210 and 2,551 cross-country miles were covered. During the Easter week-end Col. Anthony Deane-Drummond flew to Land's End, completing his "Gold C"; Derek Piggott's series of cross-countries during April and early May were reported in *Flight* last week.

AN unofficial gliding speed record for the 100 km triangle, set up by Peter Scott and Peter Collier of the Bristol Gliding Club on May 6, has not been confirmed, because no barograph was carried in the sailplane. The aircraft was the third Slingsby T.42 Eagle two-seater, owned by Mr. Scott, and the speed achieved was 36 m.p.h., which would otherwise have been a British national record.

THE constitution of the various Royal Aero Club committees for 1957-58 has recently been announced. Details are given below, together with names of stewards, timekeepers and other competition officials and F.A.I. representatives.

The Committee

President.—Lord Brabazon of Tara.

Vice-Presidents.—S. Kenneth Davies, Capt. Sir Geoffrey de Havilland, Lord Gorell, Viscount Kemsley of Dropmore, Sir Frederick Handley-Page, Whitney W. Straight, The Duke of Sutherland.

Chairman.—S. Kenneth Davies.

Vice-Chairman.—Air Chief Marshal Sir John Boothman.

Committee Members.—Capt. K. J. G. Bartlett, Maj. A. J. Michell-Clarke, J. G. Crammond, Lt-Col. C. F. H. Gough, E. S. Greenwood, S. Scott-Hall, R. E. Hardingham, R. G. Kent, E. H. W. Lucas, L. A. Morgan, G/C. C. S. Morice, Maj. H. A. Petre, Maj. J. Stewart, L. Swan, J. C. C. Taylor, Capt. R. H. Walmsley, F. Woodhead.

Other Committees

Finance.—Air Chief Marshal Sir John Boothman, J. G. Crammond, Maj. A. J. Michell-Clarke, E. S. Greenwood, Capt. R. H. Walmsley, F. Woodhead, L. A. Morgan.

Aviation.—Air Chief Marshal Sir John Boothman, S. Scott-Hall, R. E. Hardingham, Maj. H. A. Petre, J. C. C. Taylor, F. Woodhead, B. F. Collins, H. Best-Devereux, J. J. Dykes, W. I. Scott-Hill, F. N. Hillier, A. F. Houlberg, V. A. M. Hunt, N. Jones, H. B. Lindsay, G/C. E. L. Mole, B. J. Snook, J. N. Somers, P. A. Wills.

House.—Maj. A. J. Michell-Clarke, J. G. Crammond, R. G. Kent, E. H. W. Lucas, Maj. J. Stewart, L. Swan, Capt. R. H. Walmsley, F. Woodhead, L. R. E. Castlemaine, E. J. Earnshaw, G. B. Fellows, S/L. W. A. R. Harris, S/L. C. K. Turner-Hughes, G. H. Wilkinson.

"Royal Aero Club Gazette."—G. Dorman, J. J. Dykes, R. G. Kent, E. H. W. Lucas.

N.B.—The chairman of the Club, Mr. S. Kenneth Davies, is an *ex officio* member of all committees.

Stewards of the Club

Lord Brabazon of Tara, Lord Gorell, Maj. H. A. Petre, The Duke of Sutherland, Lt-Col. C. F. H. Gough, F. Woodhead.

Officials for Records, Races and Competitions

Timekeepers.—P. B. Mayne (chief timekeeper), Maj. J. W. Barber, Maj. A. L. Ebblewhite, A. J. Gibbons, Maj-Gen. A. H. Loughborough, L. H. Lumby.

Handicappers.—F. Rowarth (consultant), D. J. Lyons (chief handicapper), C. M. Britland, W. J. Charnley, Miss I. J. Ferguson, W. S. Johnson, D. R. Murrin, L. R. Wilson.

F.A.I. Representatives

Capt. K. J. G. Bartlett (president), S. Scott-Hall (sporting), P. A. Wills (gliding), Maj. T. W. Willans (parachuting), A. F. Houlberg (models), Col. R. L. Preston (touring), Sir Harold Whittingham (medical).

Other Representatives

British Gliding Association.—M. O. Imray.

Society of Model Aeronautical Engineers.—M. O. Imray.

Popular Flying Association.—J. C. C. Taylor.

Surrey Flying Club's "Taxi Tiger" features an enclosed front cockpit for passenger comfort and is the work of Rollasons, Croydon.

CIVIL AVIATION

NEARING THE MOMENT OF TRUTH

THE past week has been a perplexing one for those who try to keep abreast of (and make sense of) manufacturers' activities in the jet-transport market. A fortnight ago *Flight* gave its assessment of Britain's transport prospects for the future (May 3, "Where Do We Go From Here?"); and since that date events in the medium-jet sphere of speculation appear to have been moving fast.

It seems clear that B.O.A.C. are very close to a decision, and may well have announced their choice by the time these words are read. For a year or more they have been studying designs from Handley Page, Vickers and de Havilland for a high-subsonic, large-capacity medium-range (up to about 2,500 miles stage-length) jet transport with which to replace their Comet 4s from 1963 or 1964. (Bristol, it seems, have been devoting more attention to the very different short-haul jet requirements of B.O.A.C.'s sister Corporation.)

Last week there appeared a newspaper report to the effect that B.O.A.C. were about to order from Vickers a fleet of medium jet transports. No comment was forthcoming from either B.O.A.C. or Vickers: but the report might have been described as being in the no-smoke-without-fire category.

There followed, last week-end, news that B.O.A.C. captains are to evaluate the Handley Page Victor and a report that the civil development of the Victor could be offered—at low cost to the taxpayer—for 1961 delivery. B.O.A.C. confirmed that three of its Comet Unit captains—Capt. A. P. W. Cane, Capt. T. B. Stoney and Capt. H. J. Field—would evaluate the bomber, but a Corporation spokesman is quoted as having said: "No special significance needs to be attached to the fact that these three pilots are to fly the Victor."

Handley Page have subsequently released an artist's impression, as reproduced above, and some details of the "Civil Victor" (the name Commonwealth has been associated with the project). It will be powered by four Rolls-Royce Conways, will cruise at more than 600 m.p.h., and will carry a payload of "nearly 18 tons." Designed primarily for Commonwealth service, it will seat 172 passengers (reduced to 122 for London-New York), and could be in service by 1961. "The Civil Victor," state Handley Page, "will be a very cheap aircraft from the British taxpayers' standpoint for use by their nationalized air corporations. It also has a big export potential."

Last Monday came a second report to the effect that B.O.A.C were on the point of ordering a fleet of Vickers jet transports. The aircraft would be powered by four Conways, at a cost of £40 million, for delivery in about 1963. Vickers and Rolls-Royce, it was stated, would develop the aircraft without public subsidy or backing. No confirmation—or denial—of this report was forthcoming from the parties concerned.

An impression of the Civil Victor (see first news item). The wing could well be that of the proposed Victor bomber development.

There is no substance in other reports last week that B.O.A.C.'s Comet 4 plans might be abandoned; but notwithstanding de Havilland's unrivalled jet transport *expertise*, there has so far been no hint that the company is likely to build the successor to B.O.A.C.'s medium-range Comet 4. It is possible that—like Bristol—de Havilland have been inclining more towards the most challenging specification of all—a jet transport with good economics over short stages, and it may be supposed that the Comet 4A lends itself to further developments in this direction.

Any attempt neatly to summarize the present jet transport position is liable to be overtaken by events. But it could be that, of the two distinct types of jet required (one for best medium-range economics and the other for best short-range economics) *two* designs for each requirement—one new and the other a development of an existing design—are being put forward by the British aircraft industry.

CAPITAL'S FINANCIAL TROUBLES

WHEN Capital Airlines of Washington ordered four Comet 4s and ten Comet 4As last July, and at the same time placed a repeat-order for 15 Viscounts—bringing the fleet up to 75—the airline went to American sources for credit amounting to $60 million. (The complete financing of the original 60 Viscounts was handled by Vickers-Armstrongs Aircraft and by Rolls-Royce.) According to Capital's 1956 Annual Report, only recently published, "the terms of the repayment, security to be given and other matters have not been finalized."

Last week, on May 8, Capital's president, Mr. J. H. Carmichael, announced that despite the fact that the company had "successfully completed" negotiations for the necessary credit agreement with 24 banks headed by the Chase Manhattan Bank of New York, it had "considered it advisable to defer its financing arrangements for the present."

The reason given was that Capital had anticipated that "under normal conditions" the results for the first quarter of 1957 would have been "substantially better" than the actual results experienced. Because of factors beyond Capital's control this did not prove to be the case. These factors were given as: (1) Uncertainties about the outcome of trade union wage negotiations, (2) C.A.B.'s decision to turn down the airlines' request for domestic fare increases, (3) difficulty in disposing of its old aircraft, and (4) uncertainties about new route proceedings.

The implications of Capital's decision would appear to be less serious for Vickers—even though three of the 15 Capital repeat-order Viscounts have been completed—than for de Havilland. A spokesman for the de Havilland company said last week that the Capital Comets would be kept in production, since Capital had clearly stated that they would require the aircraft; the airline still had "several months" in which to confirm that it required them by the original delivery date. If, later, Capital said that they did not want them, "a further decision would have to be made." But, de Havilland added, "we are confident in the saleability of the aircraft anyway."

U.S. AIRWAYS PLAN

A FIVE-YEAR plan to modernize the United States' air traffic control system has been devised by the Civil Aeronautics Administration and submitted to Congress. The estimated cost of equipment under this programme would be $810 m., compared with $246 m. under the four-year plan announced one year ago.

Mr. Sinclair Weeks, U.S. Secretary of Commerce, stated that the increased cost of the new programme was largely caused by "telescoping of the program to effect increased readiness for jet transport service, now only two years off." The revised plan, according to C.A.A. Administrator James T. Pyle, places continued emphasis on radar as the best available solution to the traffic-control problem.

The following equipment is called for under the new scheme: 73 long-range air route surveillance radars, 23 of which have already been purchased by the C.A.A.; 115 airport surveillance radars, of which 47 are operating or planned with current funds; 43 precision approach radars, of which 23 have already been "programmed"; and 74 airport surface-detection equipment radars.

In addition, 1,230 Vortac installations are requested by 1962. During the fiscal year 1958, 30 I.L.S. units would be added to the 170 now in operation, and all 200 would be fitted with the distance-measuring feature of Vortac by 1962. Another 89 I.L.S. installations, combined with the Vortac distance-measuring component, would be introduced in 1959. The plan also calls for a total of 231 A.T.C. radar beacons (secondary radar); an increase of 77 airport control-towers to a total of 271, and an increase of three air route traffic control centres to a total of 34.

EAST MIDLANDS AIRPORT SUGGESTED

DISCUSSIONS on a scheme to establish a new civil airport to serve the East and North Midlands have taken place between local authorities in Nottinghamshire, Derbyshire and Leicestershire. It was recently reported by the Town Clerk of Nottingham that two sites were being considered, the disused airfield at Castle Donington and the airfield at Wymeswold.

Silver City's recent acquisition of Dragon Airways has resulted in new markings for this ex-Dragon Heron.

CIVIL AVIATION . . .

THE JET-AGE HEADSET

AN airline pilot's headset is unique in that it is a piece of technical equipment which at the same time is an item of wearing apparel—and is consequently subject to personal likes and dislikes. The fact that no headset yet designed has met with universal pilot-approval casts no discredit on manufacturers, whose attitude to the design of such specialized gear may be summed up as: "You tell us exactly what you want—we'll make it."

An experienced airline skipper with an inventive flair—Capt. F. C. Hill of B.O.A.C.'s Britannia Fleet—has now decided exactly what he wants; and he and a colleague, Mr. C. A. Giles, have made a prototype (see photographs) which has met with the unqualified approval of senior B.O.A.C. captains.

Capt. Hill's aims were lightness, comfort, and an easily adjustable microphone boom. The latter item on some conventional sets is prone to fracture after a period of use, as well as being difficult to adjust precisely, and the new design incorporates a universal joint, adjustable in three dimensions with a locking device, which permits very precise positoning of the microphone.

Lightness has been achieved by careful choice of materials, and by sensible detail design. For example, the heaviest part of the oxygen attachment—the clip—is on the attachment rather than on the headset. The complete headset, which has standard earphones and mike, just tips the scale at 7½ oz. (The standard aircraft 5ft cable and socket weigh an additional 4 oz.)

The comfort of the set, as *Flight* can testify, is excellent. Lightness, of course, makes the greatest contribution to comfort, but other small details are worth recording: (1) There are no sharp corners, and the ear-pieces are prevented from sliding off by closed loops; (2) The air-cones are of polythene, which is medically satisfactory, and they are cushioned against the ear with nylon-covered foam p.v.c., covered with washable (or expendable) cellular fabric—a big improvement on rubber or leather.

The new lightweight headset designed by Capt. F. C, Hill of B.O.A.C., as described above. The microphone boom is adjustable in all three dimensions, and can be precisely positioned.

Negotiations for production are in hand, and enquiries should be addressed to Mr. C. A. Giles, 58 Newbury Gardens, Ewell, Surrey, England.

INDEPENDENT SETBACKS

ONLY ten flights are being flown by Eagle Aviation on the London-Perpignan "Spanish Eagle" service, which will terminate on June 9. Approved by the British Government as the scheduled carrier for this route earlier this year, Eagle have been refused permission by the French Government to fly the route on a regular basis.

Another British independent operator, Skyways, has postponed the opening of its coach-air service to Lyons and Nice because agreement with the French Government has not yet been reached concerning the fare-structure on this route.

BREVITIES

RECONSTRUCTION of Prestwick's main runway is expected to begin in the late summer of this year, and the M.T.C.A. hope to have the work completed by the spring of 1958.

* * *

An improvement in airport runway lighting—intended to "light the black pit between the rows of runway lights"—is being sought by the Civil Aeronautics Administration in an experimental programme at Andrews A.F.B., Washington.

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Three further Nord 2502 civil Noratlas aircraft have been ordered by U.A.T.; this will bring its Noratlas fleet to seven.

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Mr. Robert Six, president of Continental Airlines, is on record as having said recently: "We are very interested in a small jet airplane." This would be of about 105,000 lb, economical ranges of 300-900 miles. "Both Douglas and Boeing are working on it," he said, "but we need an engine, something in the 5,000-6,000 lb class."

* * *

The Sud-Est company is reported to be considering a version of the Caravelle for the American market with General Electric J79 (CJ-805) engines—the 10,500 lb thrust engine of the 880. This, presumably, is the engine which the Republic company will install if it exercises the option which it holds on licensed production on the Caravelle in the U.S.A. M. Georges Hereil, president of Sud-Est, has said that Varig of Brazil and Avensa are showing "particular interest" in the Caravelle. An American source states that (as previously reported in these pages) Trans-Australia Airlines are "near to ordering."

* * *

Under B.O.A.C.'s recently changed sales organization, a U.K. sales headquarters has been set up at Trinidad House, 29-30 Old Burlington Street, London, W.1. Mr. G. R. Deshayes, district sales manager for London, and his team of representatives covering London, the Home Counties and the West Country, will not be based at this address, but will shortly move from Airways Terminal to the B.O.A.C. office in Regent Street. Passenger reservations office, tours office and freight reservations office remain at Airways Terminal. At Trinidad House, Mr. Alan Bennett is U.K. sales manager.

KANO

Nigeria Proudly Opens its New Air Terminal

"Flight" photograph

THERE can be few places in the world where the contrast between modern and ancient is more striking than it is at Kano, main city of northern Nigeria. Within a few minutes' drive of the old walled city, where the Emir's people adhere to the Moslem and feudal principles of a thousand years ago, there now stands a new airport terminal which is a model of its kind. As recorded last week, the building was opened on May 4 by the Governor of Nigeria.

Kano's importance as an airport is evident from a glance at the map. Lying on the southern fringes of the Sahara Desert, it provides a natural staging point for the long desert trunk-route crossing between Europe and South Africa and—to a lesser extent—West Africa. It is, furthermore, an ideally situated connecting-hub for feeder-service spokes to and from points all around, and there is a rail connecton with the port of Lagos facilitating the bulk delivery of aviation fuel.

Kano is mainly a transit airport—indeed, 90 per cent of passengers handled there are either passing through (by B.O.A.C., W.A.A.C., Air France, K.L.M., Sabena, PanAm or S.A.A.) or connecting with local feeder services (W.A.A.C. and C.A.A.).

The first aircraft ever to land at Kano were R.A.F. D.H.9As, based at Khartoum and *en route* for Lagos. That was in the 1920s. The first commercial services began on February 16, 1936 when, as commemorated by a plaque in the main concourse of the new terminal, D.H.86s of Imperial Airways connected Kano with the H.P.42 Hannibal services to Khartoum. The D.H.86s used to land on the 1,200ft polo ground to the north of the old city. The present site, also to the north, was chosen in the latter thirties, when two runways were built. During the war Kano proved an asset to the Allies as a refuelling point for R.A.F. fighters which had been shipped to Lagos for ferrying overland to Egypt, to avoid running the Mediterranean bombing gauntlet. The old terminal building, now of course superseded, was built during wartime.

By 1950 it was realized that a new runway would be needed if Kano was to be able to handle increasingly heavier, longer-range aircraft. Work began in 1951, and in November 1953, Kano proudly opened to traffic, including U.A.T.'s Comet 1As, a new 8,610ft paved and bitumen-surfaced runway, 200ft wide, with a 200ft stopway at each end. Allowing for Kano's 1,553ft altitude and tropical temperatures (runway temperature during *Flight's* recent visit rose to above 150 deg F), the equivalent sea-level length for jet aircraft is about 7,000ft. Final compaction of the runway's foundations was done mainly by squads each comprising a hundred local workmen armed with heavy tamps, working—with apparent delight—to the rhythm of drums and cymbals.

Total cost of runways, taxiways and apron was about £243,000, plus a further £60,000 for the Calvert sodium cross-bar approach lights and runway and taxiway lights (all provided by G.E.C., and specially designed to cope with the Harmattan, Kano's seasonal dust-laden wind from the desert).

Plans for the new terminal building were first drawn up in 1951 by the Nigerian Government's Department of Civil Aviation and the Department of Public Works. These authorities sought the advice of the M.T.C.A. at home, and also of the airlines—particularly of B.O.A.C. A "substantial" part of the new terminal's £500,000 cost was contributed by the British Government on behalf of the Corporation. Judging by U.K. standards, Kano appears to have obtained remarkably good value for money.

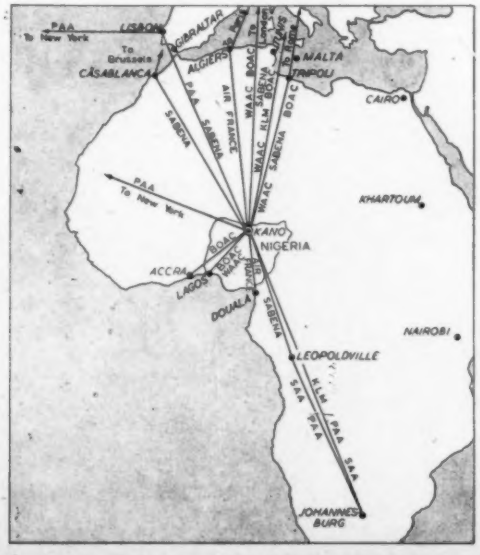
Credit for the terminal's appealing architecture—interior and exterior—goes to Nigeria's Public Works Department, and in particular to a young engineer-architect named McCloughlin. The D.C.A., W/C. E. H. Coleman, A.F.C., A.F.R.Ae.S., also contributed to the broad brushwork.

Design had to take account of the fact that most of Kano's passengers pass through at night, mainly because of the smoother desert crossing. The central feature is a big 400ft lounge built on the middle floor in the form of a bow-fronted crescent overlooking the apron and airfield (see photograph above) with full amenities for the comfort, refreshment and information of up to 500 passengers at a time. The east ground-floor wing is devoted to the clearance and handling of freight, and the west wing to airport vehicles, with a spectators' terrace above. The centre ground-floor is devoted to the main concourse, with airline booking counters and the usual amenities, and with access *via* four customs, health and immigration areas to the airport.

The third floor, where the commandant (Mr. G. Fuller-Quin) has his office, is devoted to the operational facilities. From here Kano will discharge its responsibility for the whole Nigerian flight information region (except around Lagos below 10,000ft during daylight). The offices on this floor, which will be devoted to met. and aeronautical fixed services and to flight-planning, are still in the process of being equipped. Behind them is a separate block of business offices for the airlines.

The control tower will be in use very soon, replacing the temporary structure by the apron (for which, says Mr. F. N. Plum, Kano's senior A.T.C. officer, "a flight plan needs to be filed whenever our local storms suddenly blow up"). Like other major parts of the building, the new tower is completely air-conditioned.

Nigeria has reason to be proud of its airport-of-entry.



Dignitaries seen here with the Governor, Sir James Robertson, at the opening of Kano on May 4 are the Northern Premier, the Sardauna of Sokoto, and (extreme right) the Emir of Kano. On the left is Dr. K. O. Mbadiwe, Nigerian Minister of Aviation, and (third from left) the D.C.A. of British West Africa, W/C. E. H. Coleman.

"Flight" photograph

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

This Spitfire 9, freshly painted in its original colours, has been presented by No. 14 Sqn. at Oldenburg to No. 124 Wing as a Wing trophy and was "on parade" for the farewell ceremony to Oldenburg's retiring commander, G/C. C. C. Stapleton. It was obtained by the squadron from the scrapheap at Eindhoven, where it is believed to have been left by No. 16 Sqn. (now based at Celle) at the end of the war.

E.T.P.S. Commandant

THE traditional "titfer" worn by the Commandant of the Empire Test Pilots' School on semi-official occasions was handed over at a dining-in night last week to the new Commandant, G/C. R. E. Burns. Many friends from Service, industry and the Ministries had gathered to welcome him and to dine-out G/C. S. Wroath, the retiring Commandant. Speakers recalled "Sammy" Wroath's long history of flight testing since 1938, when he was seconded from No. 1 Sqn. to Martlesham Heath; his work had been instrumental in the development of the art of test flying and his name was a passport to any flight test centre abroad.

Sir Ralph Sorley, paying tribute to G/C. Wroath, said of him that he had always looked into the future and had done much for the furtherance of test flying.

The new Commandant presented a desk-set to his illustrious predecessor, who said modestly in reply that he felt he "had made some contribution." The test pilot's day was not past and training for test flying was still required.

Senior Appointments

AWARTIME commanding officer of No. 43 Sqn. ("The Fighting Cocks"), A.V-M. C. G. Lott, has been appointed Commandant of the School of Land/Air Warfare at Old Sarum. For the past two years he has been A.C.S. (Air Defence) at SHAPE and before that was in Fighter Command for five years, first at H.Q. and then as Caledonian Sector Commander.

A.V-M. Lott joined the R.A.F. as an aircraft apprentice in 1922. He became a sergeant pilot in 1928, was commissioned in 1933 and took command of No. 43 Sqn. soon after the war started, leading its Hurricanes on many patrols over Dunkirk and Occupied France. He was awarded the D.S.O. and D.F.C. for these operations and was wounded—losing an eye—just before the Battle of Britain. Until 1944 he served with Fighter Command and then joined the R.A.F. Delegation in Washington. When the R.A.F. Flying College was formed in 1950 he became its first Chief Instructor.

The appointment has also been announced of A. Cdre. E. J. Corbally as A.O.C. No. 61 Group, Home Command, with the acting rank of air vice-marshal. He has been Commandant of the Aircrew Selection Centre, Hornchurch, for four years after being Director of Training at H.Q. Allied Air Forces Central Europe.

A.V-M. Corbally entered Cranwell in 1927 and after graduation spent 18 months in No. 1 (Fighter) Sqn. Early in the war he was a member of the Organization staff at H.Q. Bomber Command, then in December 1941 took command of No. 78 Sqn., flying Whitleys and Halifaxes. From May 1942 to July 1943 he commanded the bomber station at Pocklington. He then spent four months as Deputy Director of Bomber Operations at Air Ministry, and served for nearly two years on the Anglo-American Joint Operational Planning Committee which co-ordinated bombing plans.

Operation Pied Piper

WHEN the commander of Fort Telanok in Central Malaya sent out an urgent message recently for feline assistance to keep down rats, R.A.F. Kuala Lumpur conscripted two large Malayan cats to be dropped by parachute, with supplies for the fort, from a Valetta of the Air Supply Force. Unfortunately they both went A.W.O.L. during the night, but Capt. J. E. Bosworth, ground liaison officer in the R.A.F. operations room, had two replacements to spare. These were packed in a padded case drilled with air-holes, provided with a tasty in-flight meal of fish, and safely parachuted into Fort Telanok, where they immediately became operational.

IN BRIEF

At the invitation of the Italian Air Force, Air Chief Marshal Sir Dermot Boyle, the C.A.S., flew to Rome (by Comet 2 of No. 216 Sqn.) on May 8 for a visit to Italy.

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Two Swift F.R.5s and two Canberra P.R.7s will represent 2nd T.A.F. in the second annual reconnaissance competition organized by Allied Air Forces Central Europe, next week at R.A.F. Laarbruch.

During his recent visit to R.A.F. Honington, General K. Hayashi, chairman of the Japanese Joint Staff Council, inspected a parade in his honour (below) and met the crew of a Shackleton (right). He also examined Canberra, Valiant, Vulcan and Comet aircraft and afterwards watched them give a flying display.

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